AUGUST 1946 — FIFTY-SECOND YEAR

MACHINERY

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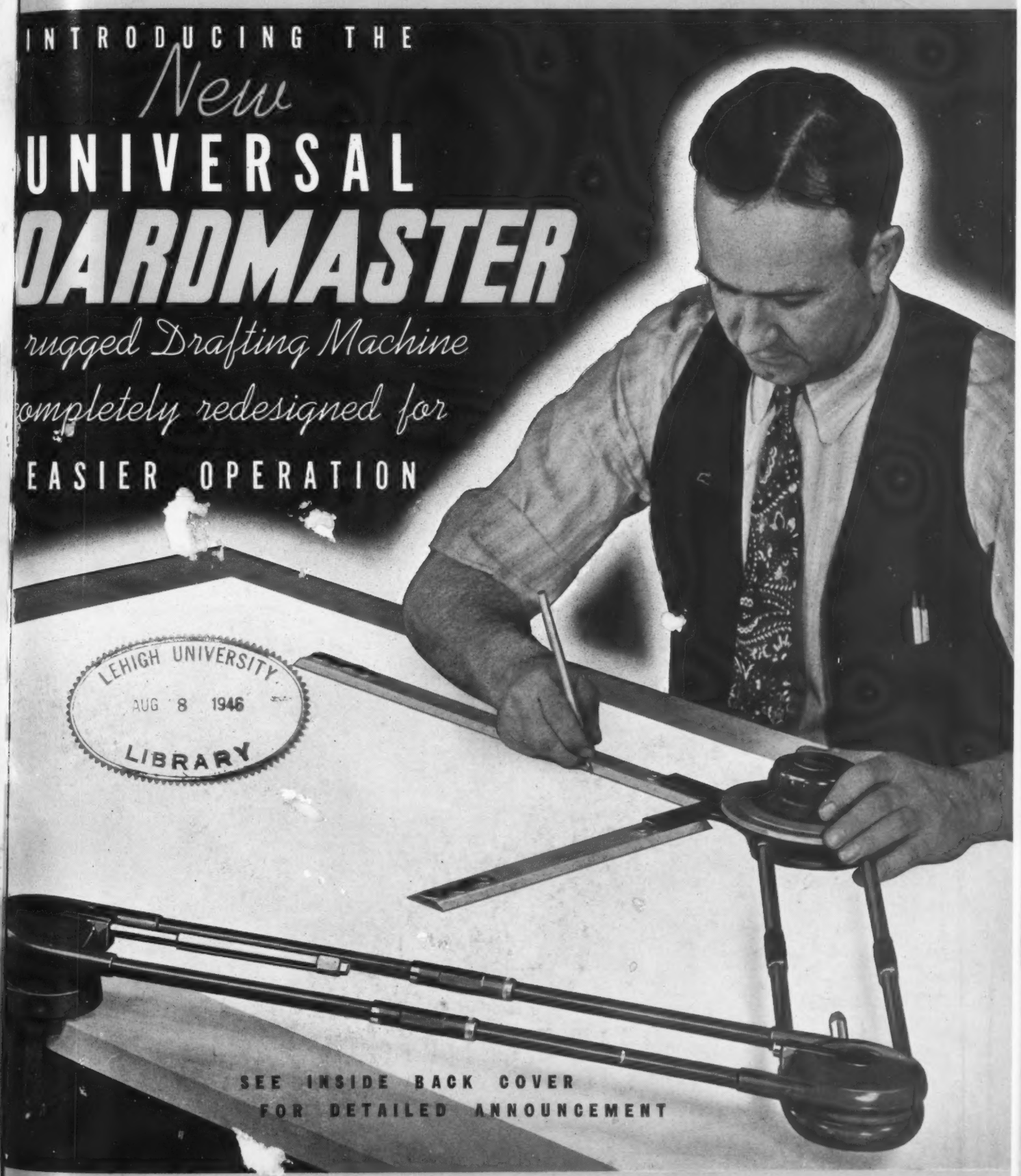
New
UNIVERSAL
DRAFTMASTER
rugged Drafting Machine
completely redesigned for
EASIER OPERATION



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NIVERSAL DRAFTING MACHINE CO., CLEVELAND 14, OHIO

FOR BETTER GAGING . . . "GO" GREENFIELD

ARE YOU USING
Chromium Plated
THREAD GAGES for EXTRA WEAR?
The longer life of chromium plated gages more than makes up for their high first cost and results in worthwhile net savings.
While "Greenfield" has supplied chromium plated gages for many years, wartime expansion of facilities and research has enabled us to greatly improve our methods and quality. Now we can furnish a vastly superior product including Thread Gages as well as plain gages.
For further information on "Greenfield" chromium plated gages, call your "Greenfield Man" through your local "Greenfield" distributor.
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GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

AUGUST, 1946

PRINCIPAL CONTENTS OF THIS NUMBER

For Complete Classified Contents, See Page 250

Two articles recently published on the subject of light-gage metal spinning evoked so much interest on the part of MACHINERY'S readers that the editors decided to present an article dealing with the spinning of steel plates as thick as 6 inches. This article will appear in MACHINERY for September. It describes the practice of a well-known steel company in the making of heads of various cross-sectional shapes for pressure vessels. The heads range up to more than 18 feet in diameter and 18 tons in weight.

Cold-Forming Oldsmobile Three-Piece Bumpers *By Charles O. Herb* 141

Cemented Carbides Used for Other Purposes than Cutting Tools *By K. R. Beardslee* 150

Speeds, Feeds, and Lubricants for Reaming - - - - - - 157

Hydraulic Oils for Industrial Equipment - *By J. C. Van Gundy* 158

Resistance Welding with Storage-Battery Power—A New Development in Electric Welding - - - - - - - - - 167

Surplus Equipment Should be Available to Educational Institutions at Reasonable Prices - - - - - - - - - 174

From Aluminum Oxide to Rolled Aluminum Sheets - - - 176

Rapid Milling of Propeller-Shaft Bearings - - - - - - 180

Induction Heating Applications in the Machine-Building Industries - - - - - - - - - - - - - - - - 181

Editorial Comment - - - - - - - - - - - - - - - - 188

A Step toward Real Union-Management Cooperation—Needless Accuracy May Add Greatly to Cost of Production

DEPARTMENTS

Engineering News - - - - - - - - - - - - - - - 186

Ingenious Mechanisms - - - - - - - - - - - - - 189

Questions and Answers - - - - - - - - - - - - - 194

Tool Engineering Ideas - - - - - - - - - - - - - 195

Materials of Industry - - - - - - - - - - - - - - 198

Shop Equipment News - - - - - - - - - - - - - 201

New Trade Literature - - - - - - - - - - - - - 228

News of the Industry - - - - - - - - - - - - - 236

Data Sheet - - - - - - - - - - - - - - - - - 245

Volume 52
Number 12

Product Index 418-431
Advertisers Index 433-434

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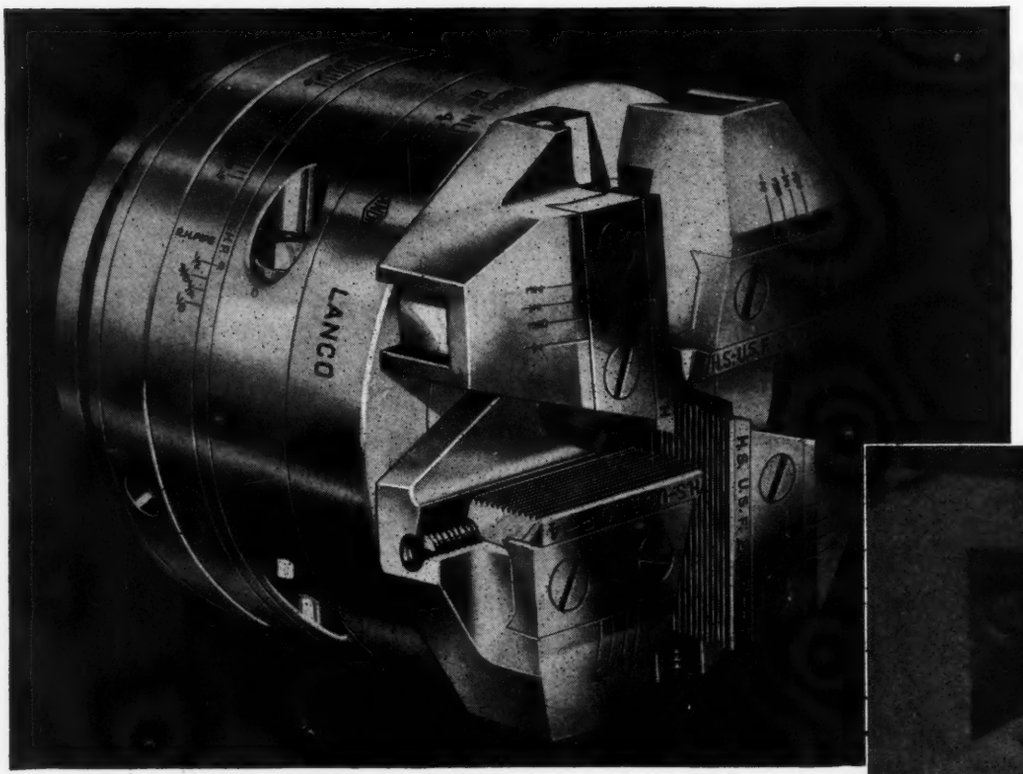

For

The LANDMACO Threading Machine equipped with the LANCO Head will give you quality threads at low operating cost.

The LANDMACO machine illustrated is used to thread tail wheel bolts and other precision aircraft parts that must be held to rigid tolerances.

It can readily be set up to handle all types of bolt or pipe threads and it assures smooth-finished well-formed threads of class 3 fit on the toughest alloy steel.

If you require threading accuracy and high production, let us tell you how LANDMACO machines have solved these problems for hundreds of manufacturers.

Write for Bulletin H-75
containing complete specifications
of the LANDMACO Machine

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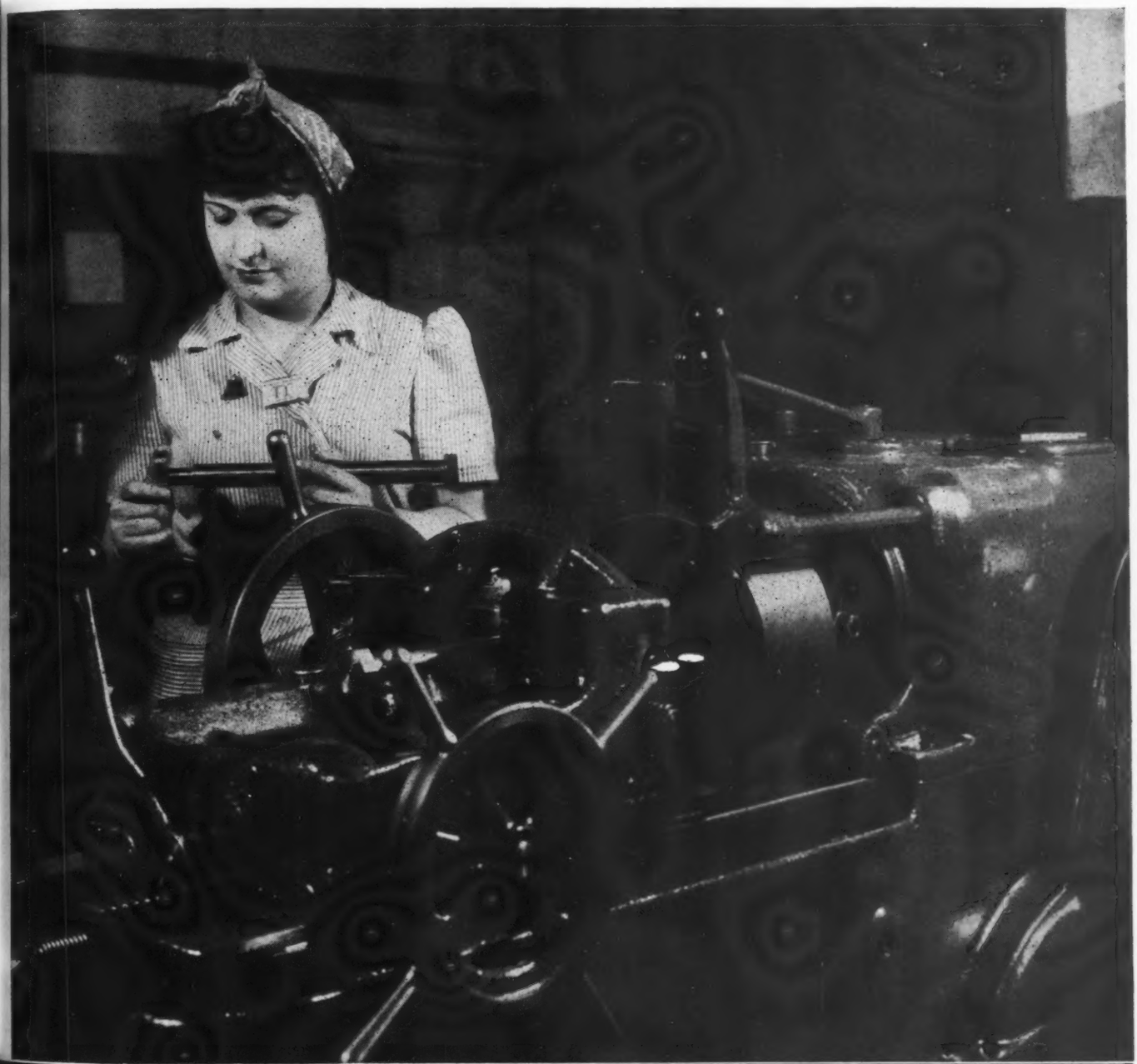
REG U.S. TRADE—MARK PAT. OFF.

LANDIS

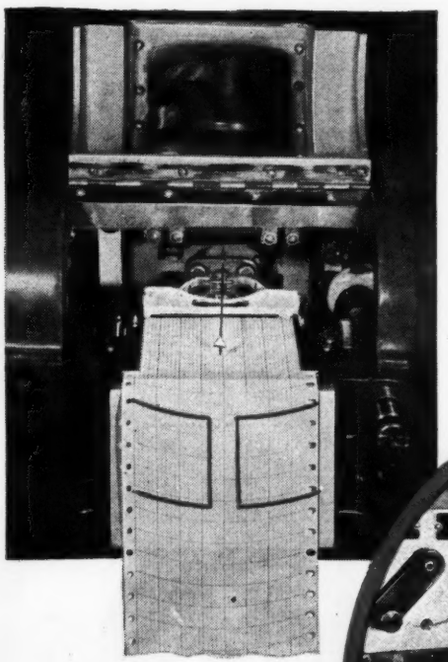
Precision Threading . . . . . .

THE LANDMACO
THREADING MACHINE

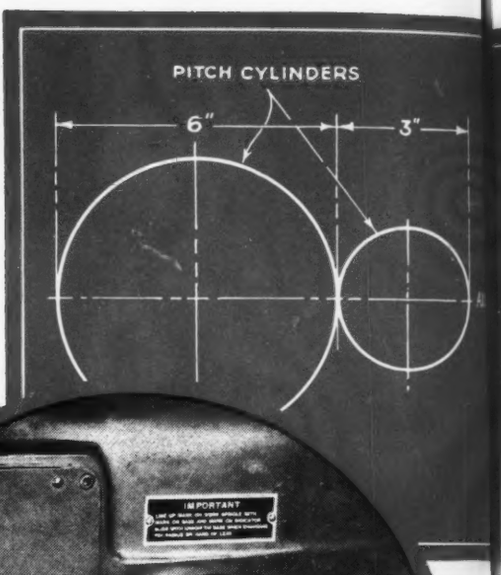


MACHINE CO. WAYNESBORO PENNA. U.S.A.

FELLOWS PRESENTS *Lead Checking*



An Electrical Recorder automatically produces an accurate, permanent charted record of the relationship of the tooth face with reference to the gear axis.



Close view—checking a right-hand helical gear. Note 1/10,000 dial indicator for direct reading of tooth deviations.

OUTSTANDING ADVANTAGES

- *OF BASIC DESIGN*
- *CONTINUOUS ORIGINATING TYPE*
- *GAGE BLOCK SETTING*
- *EASY TO OPERATE*
- *NO INVOLVED CALCULATIONS*
- *ERRORS READ DIRECT*
- *ERRORS MAGNIFIED 500 TIMES*
- *PERMANENT CHARTED RECORDS*
- *FUNCTIONING OF INSTRUMENT EASILY CHECKED*

GOVERNMENT SURPLUS MACHINE TOOLS...We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vt.; or our offices in Detroit, Mich. and Chicago, Ill.

THE FELLOWS METHOD...MACHINES AND TOOLS FOR

Simplified

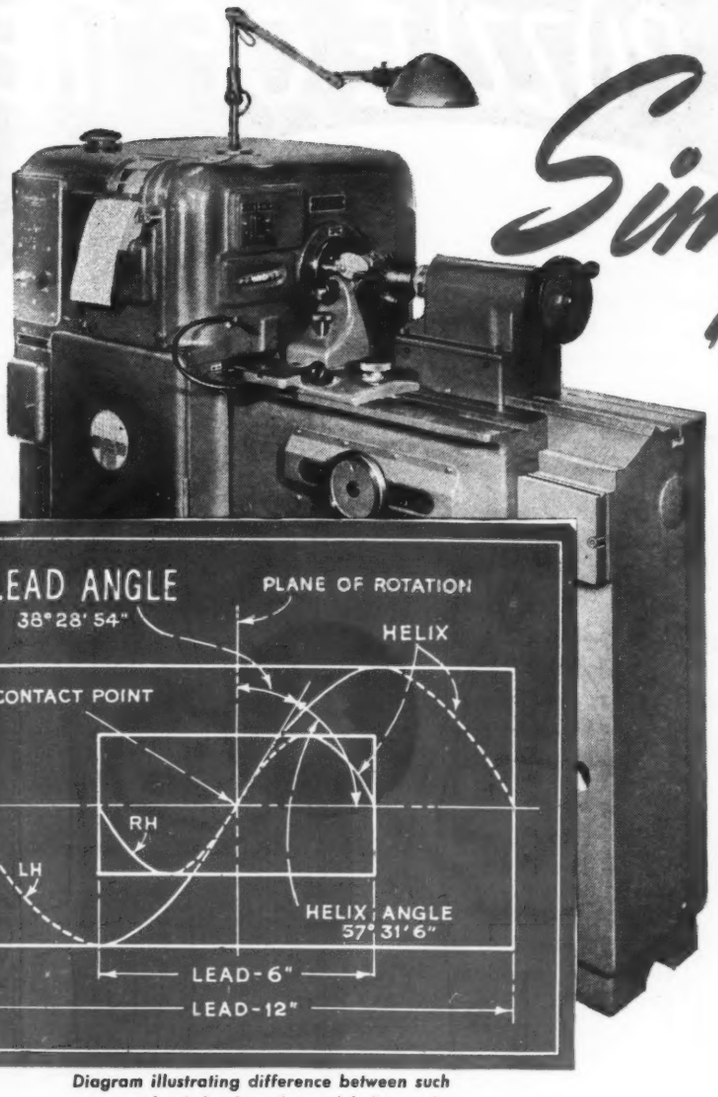


Diagram illustrating difference between such terms as lead, lead angle and helix angle.

...IN A NEW INSPECTION INSTRUMENT OF TYPICAL FELLOWS BASIC DESIGN

This new No. 12H Lead Measuring Instrument ranks with the Fellows Involute Measuring Instrument and the Red Liner, as an outstanding development in equipment for accurate and dependable gear inspection.

This instrument is of the continuous originating type, the actuating mechanism comprising dual tangent bars and pins for effecting rotation of the work, and the required continuous traverse of the slide carrying the measuring pointer. Both settings—traverse and rotation—are accurately set by size blocks and micrometers—with a dial indicator to control setting pressure. Variations in the tooth face of the gear teeth with reference to a helix or axis of a spur gear can be determined directly by a 1/10,000 dial indicator. A permanent chart can also be made by an electrical recorder—the deviations in the charted line being with reference to a straight line. It is, therefore, possible to determine the "off-position" of the face of a helical gear tooth in the face width; or crowning and taper of spur and helical gear teeth to a degree of accuracy that meets the most exacting requirements.

Our descriptive circular on the No. 12H Lead Measuring Instrument will give you further details and information on this outstanding development. Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit 2, Mich.—or 640 West Town Office Bldg., Chicago 12, Illinois.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

NO[illegible] THE PUZZLE OF THE

VANISHING DOLLAR?

Get this! Three gents put up at a hotel, paying $30 rent in advance. Shortly afterward the clerk discovers that he has overcharged them $5, so he sends that amount back by the bellhop. But the bellhop, a weak character, returns only $3. Now the men have paid $27 and the bellhop has $2—making a total of $29. *What became of the extra dollar?*

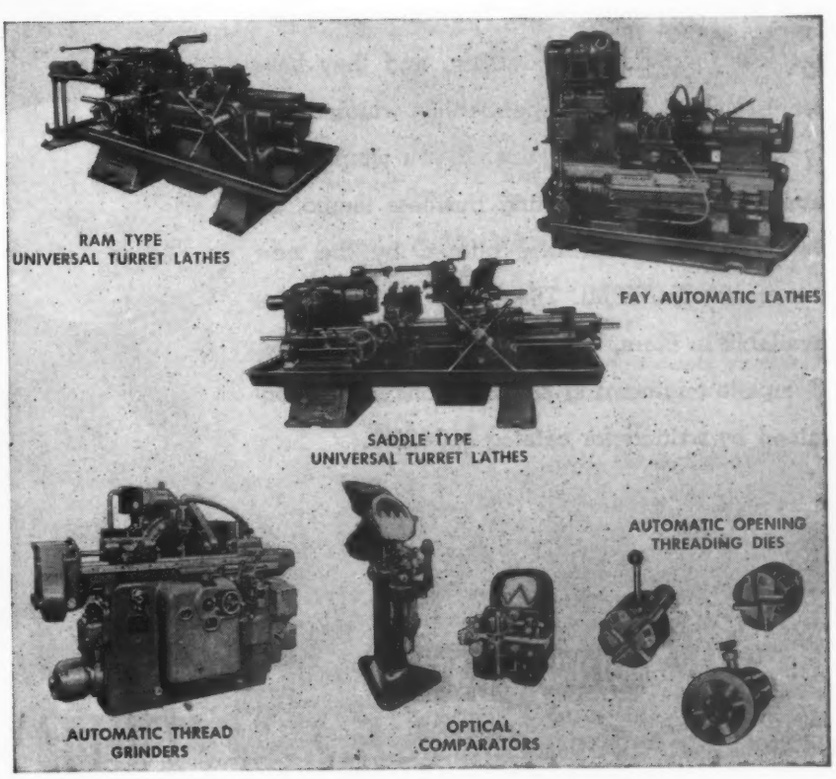
And a very appropriate little problem, too. For many's the dollar that's vanishing, these days, in seemingly simple operations.

Metal turning costs are a problem. The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

Be skeptical of the production efficiency of all metal turning equipment in your plant.

Telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.



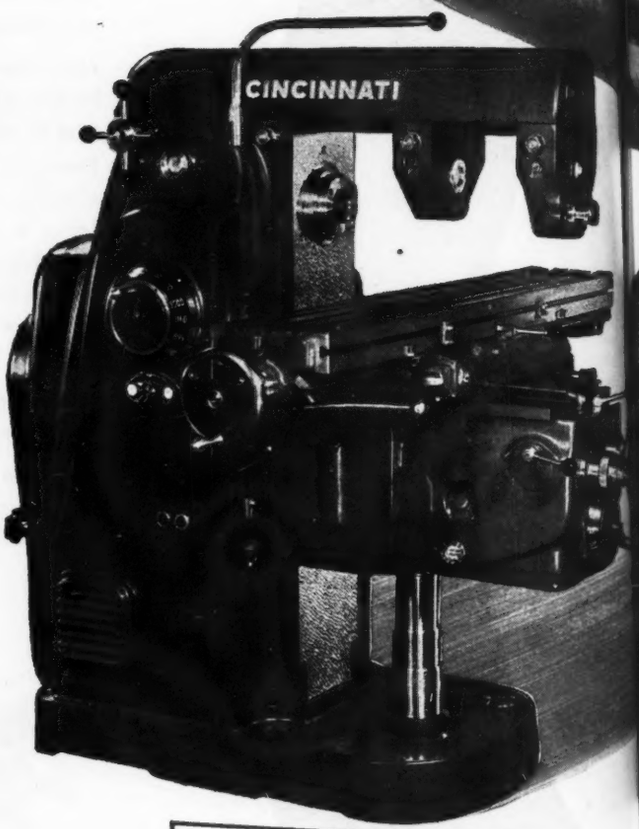
JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

A new Milling

THE NO. 2 MI

The development and building of machines that will handle machining operations to better advantage always has been the paramount aim of Cincinnati Milling. And while this end result is necessary to offset rising costs, the machine tool itself must have more than features of rapid output; it must also gain operator acceptance. The new CINCINNATI No. 2 MI Milling Machines fulfill both of these requirements. They offer many new features for today's production, and they have features of safety and dependability which quickly win operator acceptance. If you would keep abreast of the accelerating business tempo, investigate the possibilities offered by the new CINCINNATI No. 2 MI. These new machines are available in Plain, Universal and Vertical styles. Complete engineering specifications may be obtained by writing for catalog M-1429-1.



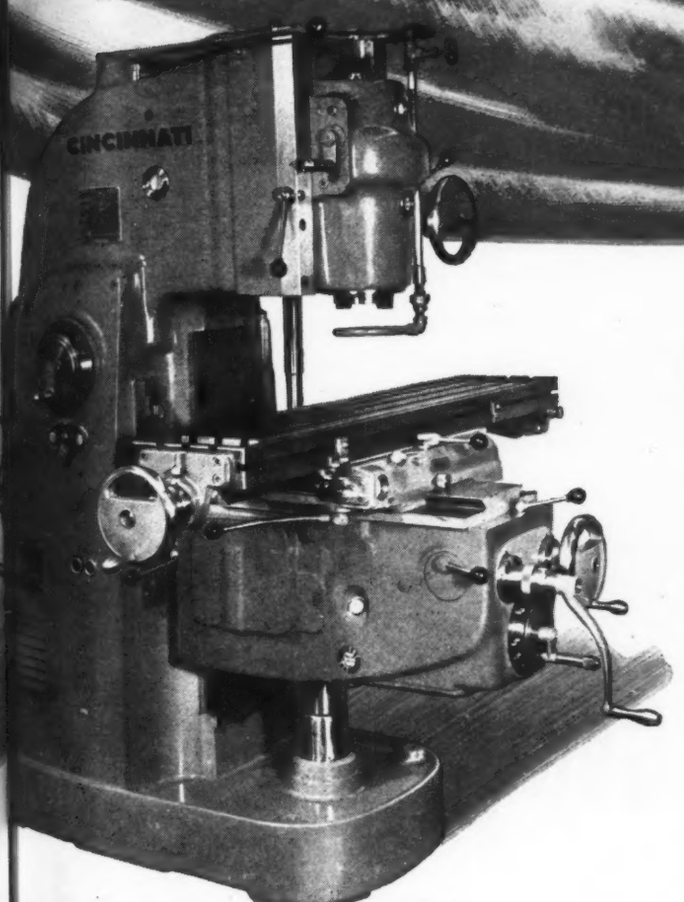
CINCINNATI No. 2 MI Plain Milling Machine

CINCINNATI

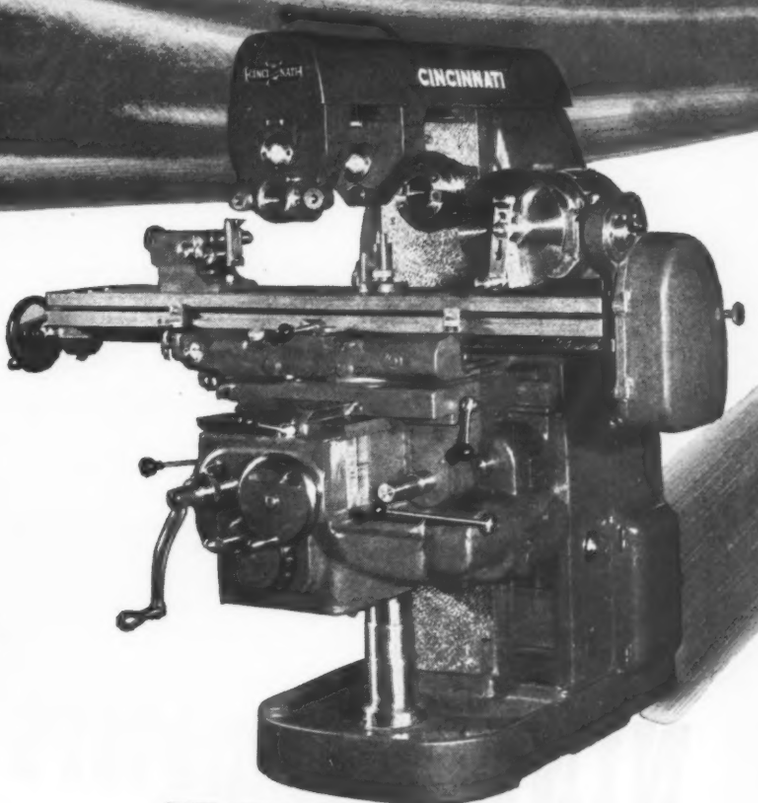
THE CINCINNATI

MILLING MACHINES

Machine BY CINCINNATI



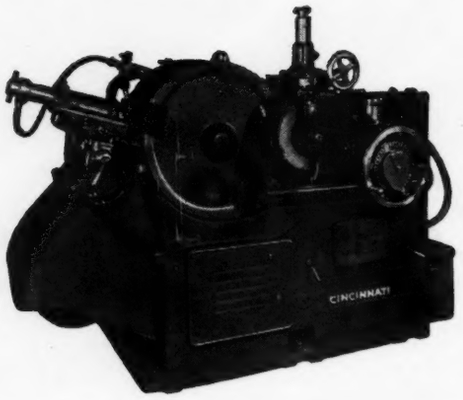
CINCINNATI
No. 2 MI Vertical
Milling Machine



CINCINNATI
No. 2 MI Universal
Milling Machine

MILLING MACHINE CO. CINCINNATI 9, OHIO, U.S.A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES



CINCINNATI FILMATIC No. 3 Centerless Grinding Machine. Engineering specifications and complete details will be found in Catalog G-438-3. Write for your copy. A brief description of the machine is given in Sweet's Catalog File.

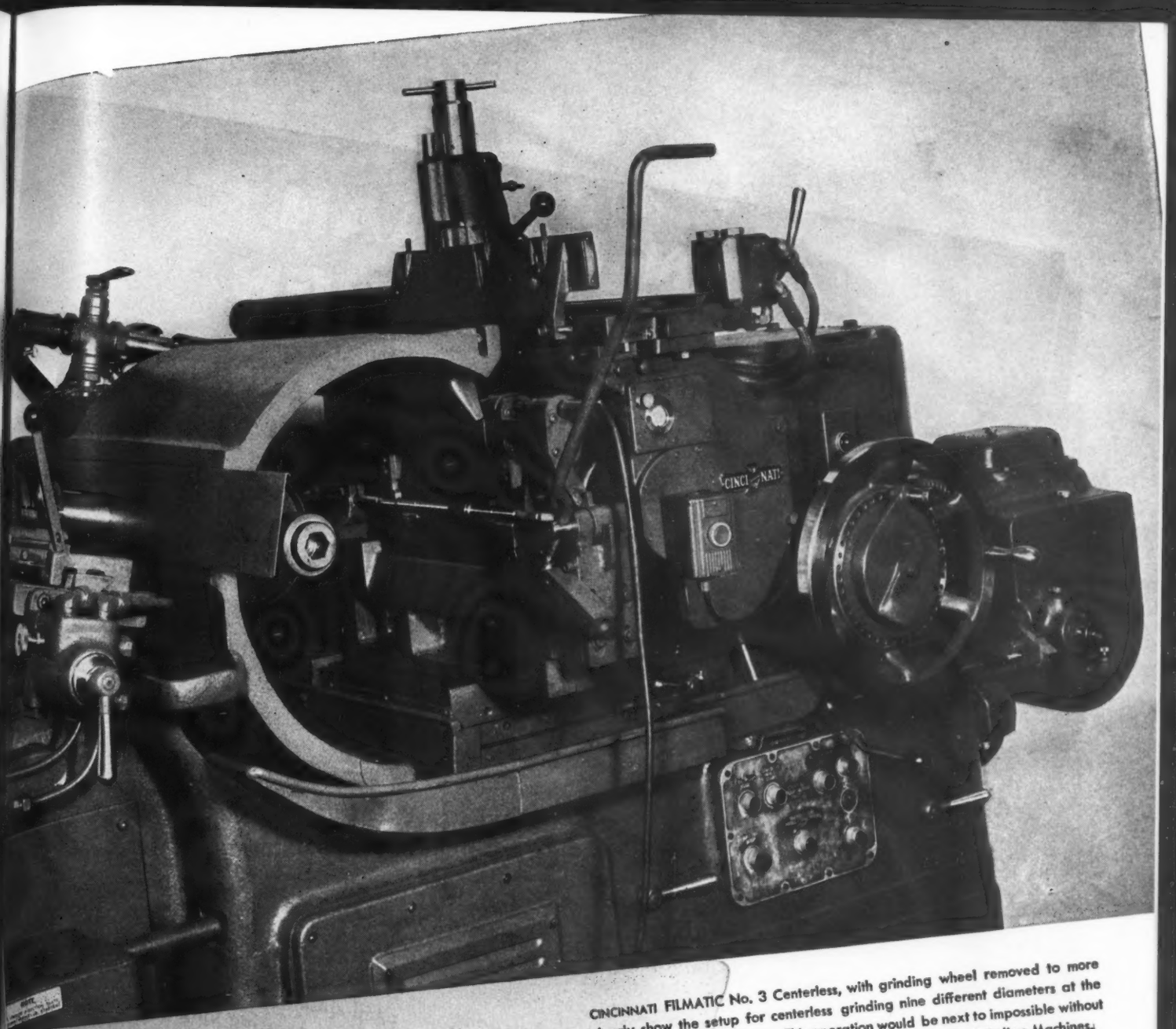
High production centertype grinding of long, slender parts is, at best, a slow, meticulous process, and the success of the operation demands a highly skilled operator. The equipment illustrated here eliminates these restrictions to the rapid production of armature shafts by accurately grinding nine diameters at the same time. ¶ The machine, a CINCINNATI FILMATIC No. 3 Centerless, was equipped with Profile Truing Attachments over grinding and regulating wheels, special Wheel Mounts to accommodate 13¼" wide grinding and regulating wheels, a special Wide Work Rest, Magnetic Work Loading Fixture, and Automatic Infeed Attachment. ¶ This machine is typical of the work of Cincinnati Application Engineers in reducing the cost of precision grinding operations, on parts ranging from large piercing punches to glass condenser tubes. Talk over with these engineers all your centerless and centertype grinding operations.

NINE Diameters Centerless Ground ... in ONE Infeed

CINCINNATI

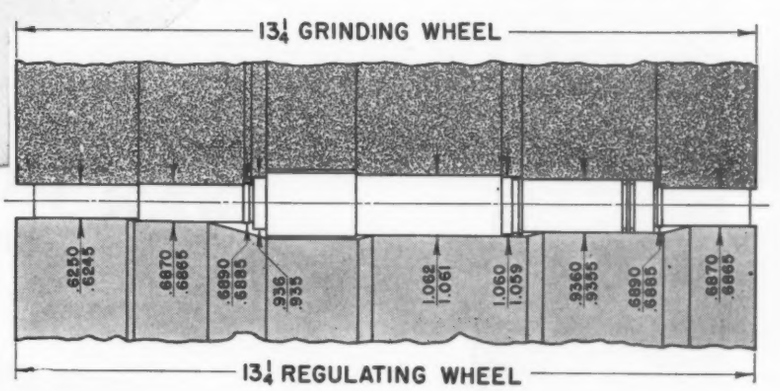
CINCINNATI

CENTER TYPE GRINDING MACHINES



CINCINNATI FILMATIC No. 3 Centerless, with grinding wheel removed to more clearly show the setup for centerless grinding nine different diameters at the same time, on parts 13" long. This operation would be next to impossible without FILMATIC bearings, a standard feature of all CINCINNATI Grinding Machines.

Operation



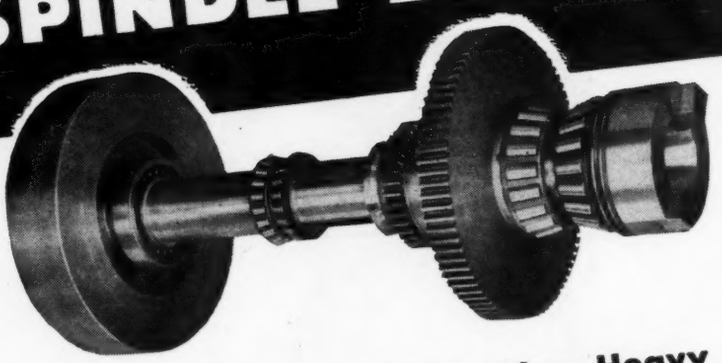
Here the armature shaft is shown between the grinding and regulating wheels. Also shown are dimensions of each of nine diameters. Production, 45 pieces per hour, complete.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

VAN NORMAN SPINDLE DESIGN



- **Built-in Spindle Flywheel Plus Heavy Bull Gear Improve Cutability**
- **Five Anti-friction Bearings, Including Double-opposed Center Spindle Bearings, Provide Maximum Spindle Rigidity**
- **Heavy-Duty Spindle Transmission Assures Adequate Power For Every Cut**

In addition to the new spindle design, Van Norman milling machines incorporate many other advantages which permit maximum ease of control and operation.

Finger-tip front and rear directional controls of all power feeds and six-way rapid traverse enable the operator to operate the machine for either position.

Hand adjustments are also provided at front and rear.

Overarm pilot wheel permits easy positioning of the heavy ram type overarm.

Single lever speed and feed selectors provide quick, instant selection of 18 speeds and 18 feeds.

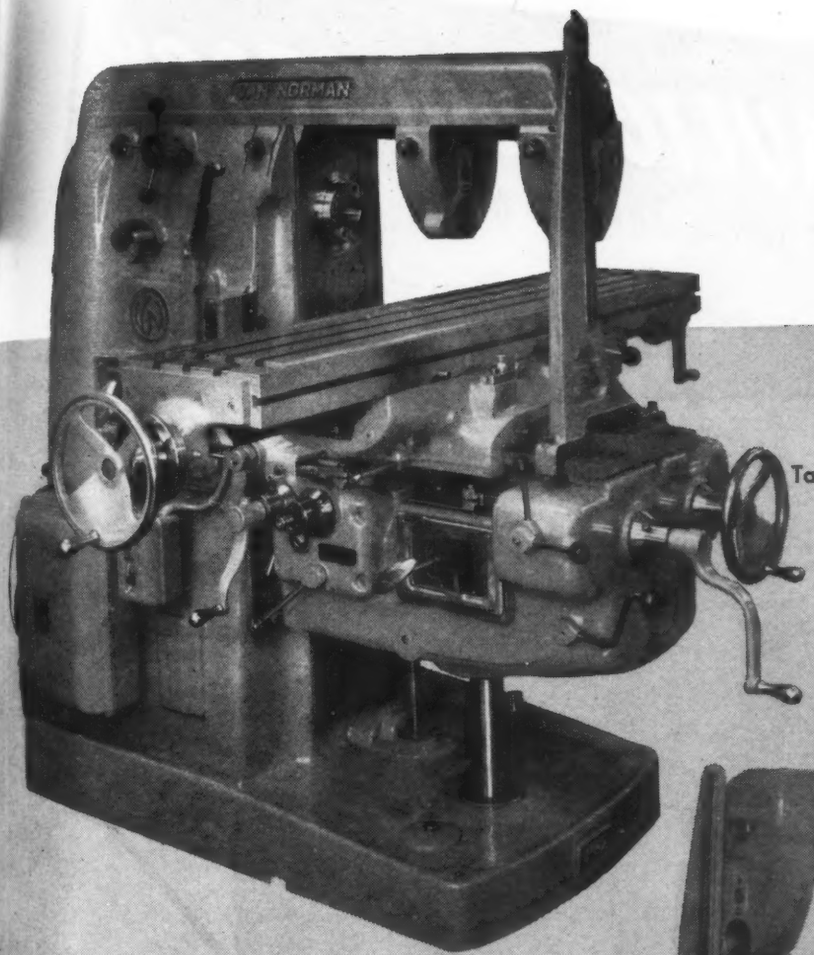
Hardened alloy steel gears mounted on multi-splined shafts rotate on anti-friction bearings, assuring long life.

Automatic lubrication assures proper oiling of all moving parts.

Investigate Van Norman Horizontal Millers today. They are available in four sizes with plain or universal saddles.

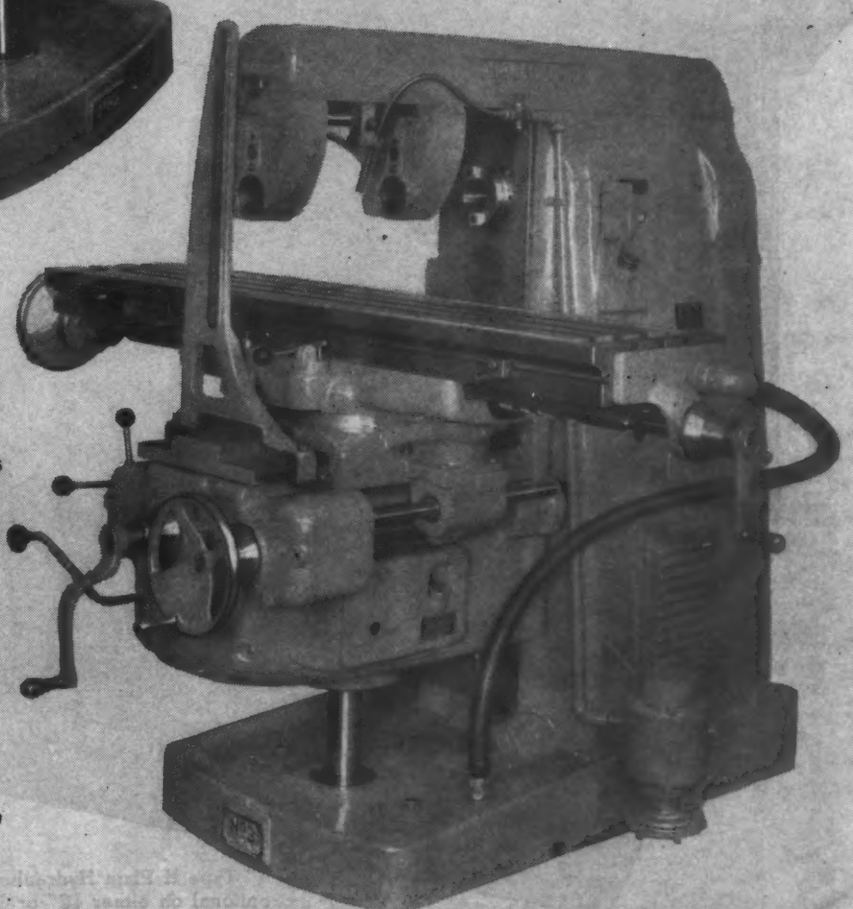
VAN NORMAN COMPANY
Springfield 7, Massachusetts

"It Pays to



No. 2 Heavy

Table: 58 x 13 inches



No. 3 Standard

Table: 64 x 14 inches

Van Normanize"

HYDRAULIC FOOTSTOCK

speeds production on 4" type H plain hydraulic grinder

4" Type H Plain Hydraulic Grinder. Hydraulic footstock optional on either 12" or 18" machine. Standard equipment includes hydraulic work table traverse, hydraulic automatic wheel feed, variable voltage headstock drive.

LANDIS TOOL COMPANY • WAYNESBORO, PA.

Loading and Unloading Speeded by FOOT PEDAL Operation

Closeup of 4" Type H equipped with hydraulic footstock. Note hydraulic line connected to footstock.

Operator Fatigue Reduced

● The addition of the hydraulically operated footstock to the Landis Tool 4" Type H Plain Hydraulic Grinder increases still further the productivity of an inherently high production machine.

Foot pedal operation frees both hands for the loading and unloading operation. Two footstock spindle lever operations are eliminated for each piece, thereby cutting down loading and unloading time. In addition, the elimination of two arm movements reduces operator fatigue.

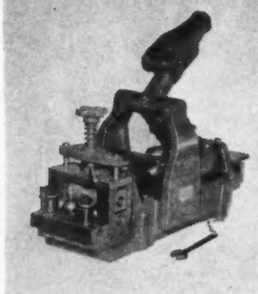
Other hydraulic features of the 4" Type H Grinder which increase productivity or improve finish are: the hydraulic table traverse with smooth traverse and reversal; automatic wheel feed that removes metal at a predetermined rate and automatically resets; also the optional hydraulic rapid infeed.

For high production with finishes of from 4 to 5 microinches, the 4" Type H will grind work up to 1½ inches in diameter. Request Catalog A44 for full information.

50

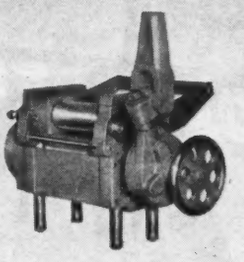
LANDIS TOOL
Precision Grinders

U. S. Slide Feeds



The U. S. Slide Feed is driven from the crank shaft of the punch press by means of an adjustable eccentric and suitable connections. The feed mechanism consists of a feed block reciprocating on hardened steel rods between adjustable definite stops. A stellite-tipped feed blade, mounted in the feed block, clamps the stock on the forward stroke; then the feed block moves forward the desired length, moving the stock with it. The pivot-mounted blade allows the feed block to be returned without moving the stock; this feature, plus a drag or roller chock, insures against movement of the stock on the return stroke. This method of operation produces a high degree of accuracy.

U. S. Roll Feeds

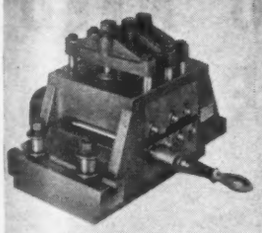


In some instances, especially where stock in short lengths is used, the U. S. Roll Feed provides a satisfactory method of automatically feeding stock into the punch press. U. S. Roll Feeds provide a most suitable method of feeding right-to-left, as the drive can be taken from the left side of the press and the material pulled from right to left. This unit is eccentric-operated from the press crank shaft. Length of feed is controlled simply by an adjusting screw on the driving eccentric, which is the only adjustment to be made for changing length of feed. U. S. Roll Feeds are precision-built for applications where Slide Feeds cannot be used.

Change your Power Presses to Automat M

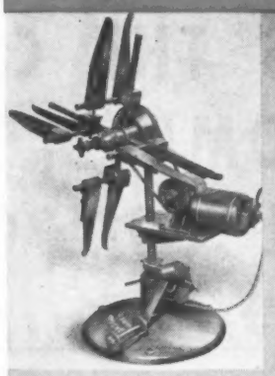
U. S. TOOL COMPANY, INC., AMPERE (East Orange), N. J.

U.S.Stock Straighteners



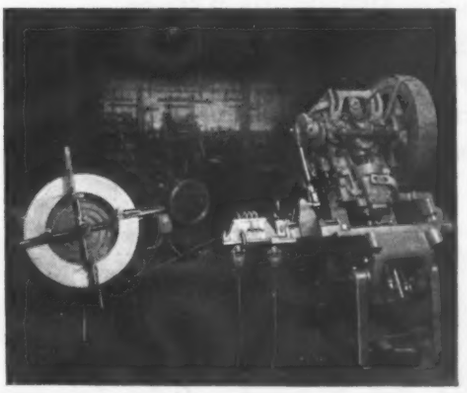
When using coil stock, it is often necessary to perform a straightening operation to obtain flat blanks, insure accuracy of automatic feeds, and maintain die life. U. S. Stock Straighteners are designed to provide an economical method of performing this straightening operation — where the automatic feed has power enough to pull the stock through the straightening rolls. This type of straightener can be mounted to a U. S. Slide Feed, as the latter has ample power to pull the stock through the straightener. These units can also be hand operated for straightening lengths of stock. They are furnished with crank-operated entering rolls.

U. S. Stock Reels



The U. S. Automatic Stock Reel will make a decided difference in speed, efficiency, and economy of feedings. This is particularly true where heavily loaded reels are operated, long feeds are run at high speed, or light materials such as paper are fed. Under such conditions, troublesome "whipping" and strain on the stock are often disastrous to efficiency in feeding. The U. S. Automatic Stock Reel maintains a loop in the stock at all times, thereby removing any strain from the stock. Even eccentrically loaded coils are easily unloaded, as the motor rotates the arms and unwinds the stock. U. S. Automatic Stock Reels are made in vertical and horizontal quick-loading types.

Machines and { **INCREASE OUTPUT**
REDUCE DIE-UPKEEP
INCREASE DIE-LIFE
CUT MATERIAL COSTS



Builders of U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories — U. S. Multi Slides — U. S. Multi Millers

FOR BOTH *Manufacture*

HERE'S THE CAPACITY YOU NEED TO COMPLETELY MACHINE DIESEL COMPONENTS

G. & L.

FLEXIBILITY **PERMITS MACHINING DIFFICULT-TO-REACH SURFACES**

OPEN CONSTRUCTION **SPEEDS HANDLING OF HEAVY, BULKY WORK**

Fewer machining difficulties are experienced in both manufacture and repair of diesel engine parts when the work is performed on the versatile Giddings & Lewis horizontal boring machine. The user is assured of ample capacity to handle all sizes and types of work. The diesel part may extend in any plane, for there are no interfering columns or supports to limit work size. Once the part is correctly set up, a wide variety of milling, drilling, boring, reaming, facing, backfacing, and similar operations are easily performed.

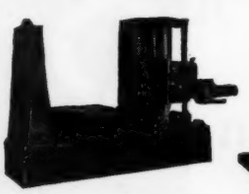
Flexibility of the Giddings & Lewis machine makes it a simple matter to raise, lower or extend the spindle to reach surfaces which would be inaccessible on other equipment. In addition, this same flexibility permits greater latitude in engine designing.

REPAIRING and REBUILDING DIESELS

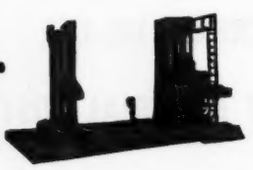
An example of one of the most common repairs made on a diesel is reboring the main bearings. This is an easy operation for a G. & L. machine. In the manufacture of an engine, main bearings are bored using some type of supporting fixture.

When repairing and reboring one, two, three or even more damaged bearings, a fixture is not required. The good bearing closest the one to be rebored is bushed to receive and support the bar. After the operation is completed, the new bore is then bushed and it in turn supports the bar.

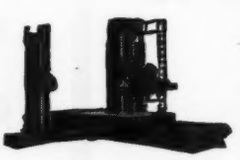
Factory repair and rebuilding operations on different diesels may be simulated in any shop equipped with a Giddings & Lewis horizontal boring machine. G. & L. engineers will be glad to recommend the machine best suited to your need. Call on them now — there is no obligation.



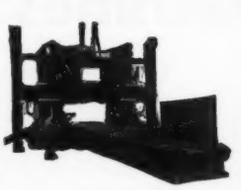
G. & L. Table Type Machine



G. & L. Floor Type Machine



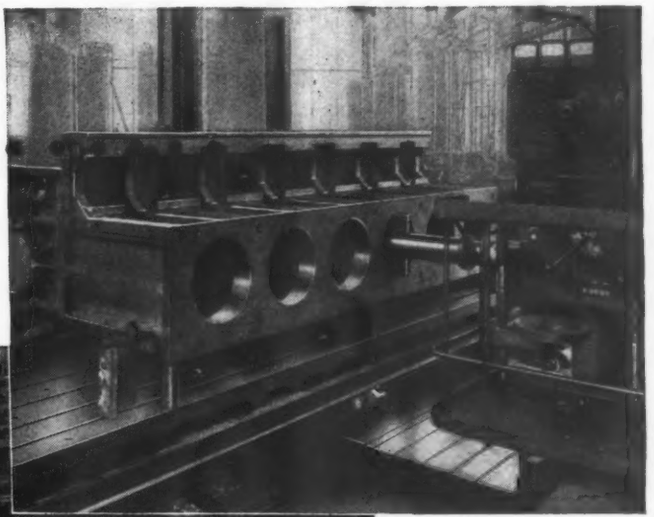
G. & L. Planer Type Machine



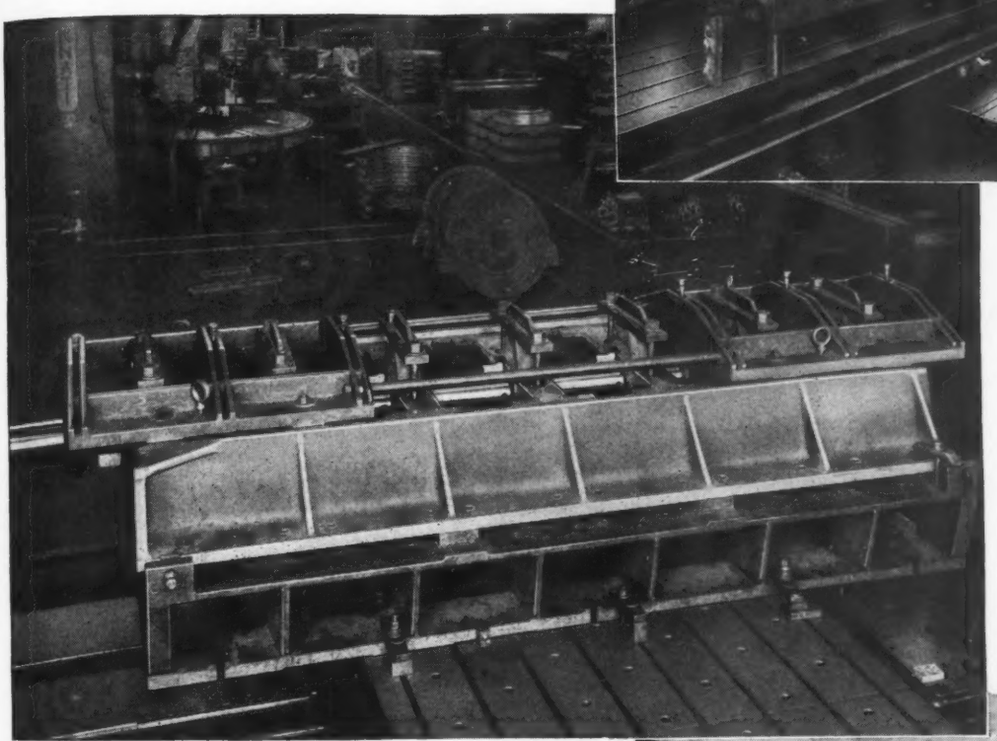
G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.

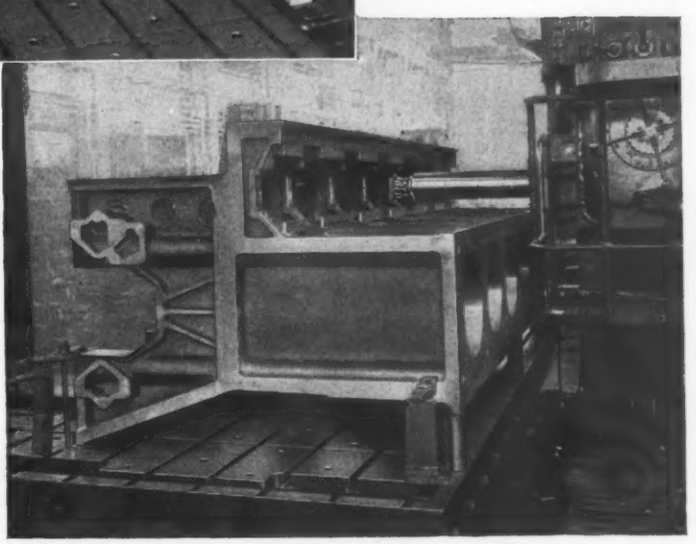
AND *Repair*.



Machine scales and verniers are used to establish hole centers on this six cylinder block. Cylinder liners will be used after boring operations are completed.



Boring seven main bearings simultaneously. Internal bar support fixture is used as shown in this manufacturing operation. To repair and rebore bearings the fixture is not used. Undamaged bearings are bushed to support and align the bar.



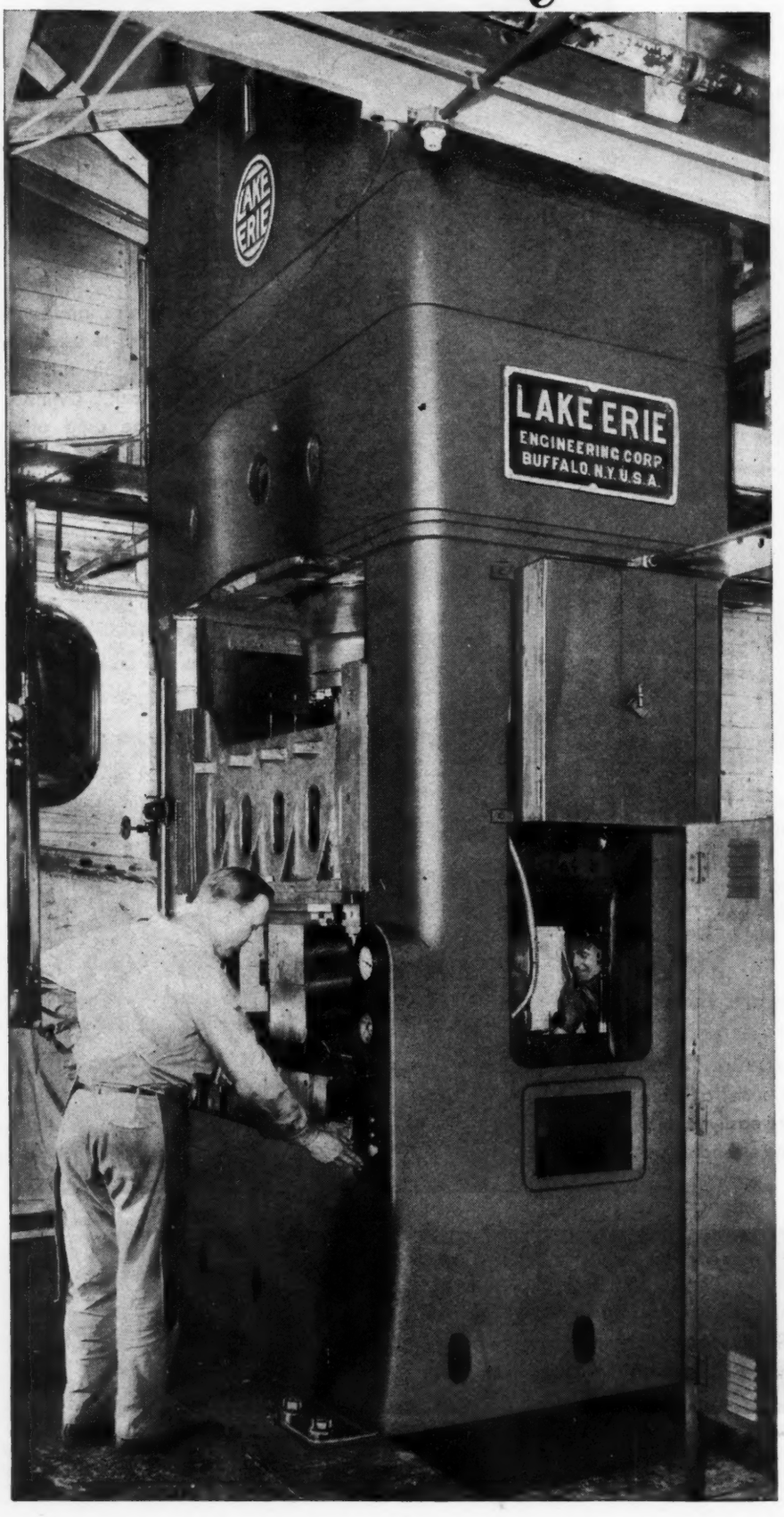
Difficult-to-reach surfaces such as this camshaft bearing saddle are easily milled by extending the machine spindle as shown.

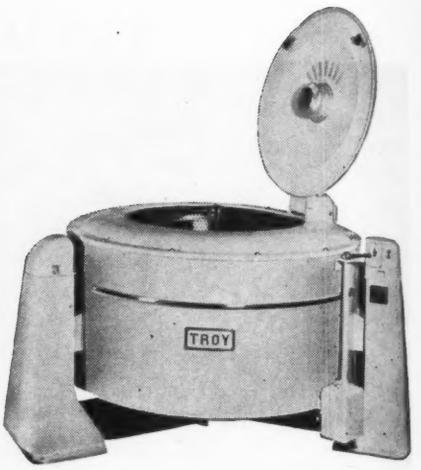
Helpful Production Facts **FREE**

Write today for applicable data covering standard and special machining problems. Actual field stories show how difficult jobs are handled. Ask for Production Data Folder M.A. 86.

140 Doty Street • Fond du Lac, Wis.

Lake Erie Hydraulic Press





A big advantage of this 450-ton Lake Erie Hydraulic Press is its versatility and ability to perform a wide range of manufacturing functions. American Machine and Metals report that the press is already handling the following types of work and more are contemplated—

- Plate forming of mild steels.
- Piercing washer trunnion spiders.
- Multiple riveting of spiders to heads.
- Deep drawing of shell doors, dump valves and door latch housings.
- Stamping stainless steel washer parts.
- Blanking fan blades and discs.
- Forming stainless steel cylinder heads.

Many manufacturers are taking advantage of the greater flexibility and efficiency of modern hydraulic presses. They are replacing outmoded, inefficient, costly methods of production with the latest Lake Erie Hydraulic Presses.

Cuts Manufacturing Costs

Eliminates patterns... machine work... expensive castings and complicated fabrication

A good example of the way in which modern hydraulic presses make it possible to improve product quality and decrease manufacturing costs is provided by American Machine and Metals, Inc., of East Moline, Illinois. Formerly, the pedestals and shell for the Atlas Laundry Extractor, manufactured for their Troy Laundry Machinery Division, were made of cast iron. Now they are formed out of sheet steel. American Machine and Metals point out the following advantages for this type of construction:

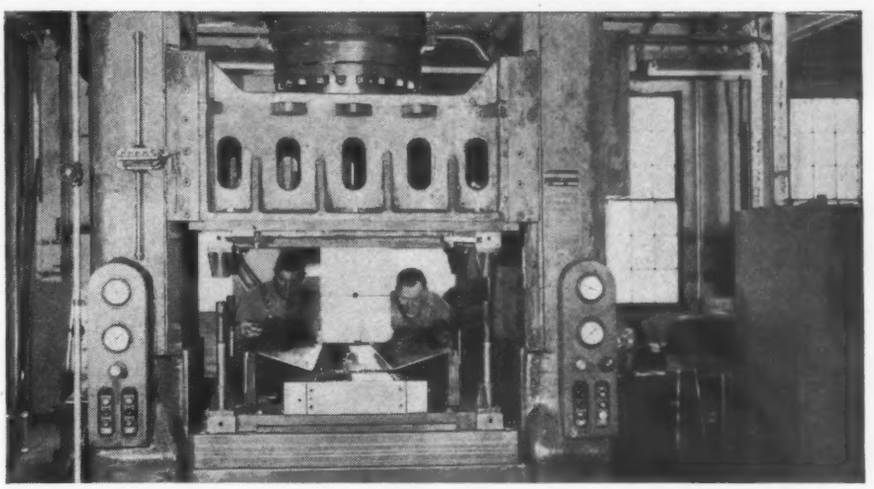
FLEXIBILITY
of machine proper, eliminating rigidness, strain and resultant breakage.

STRENGTH
allowing use of lighter material for less over-all weight of given part.

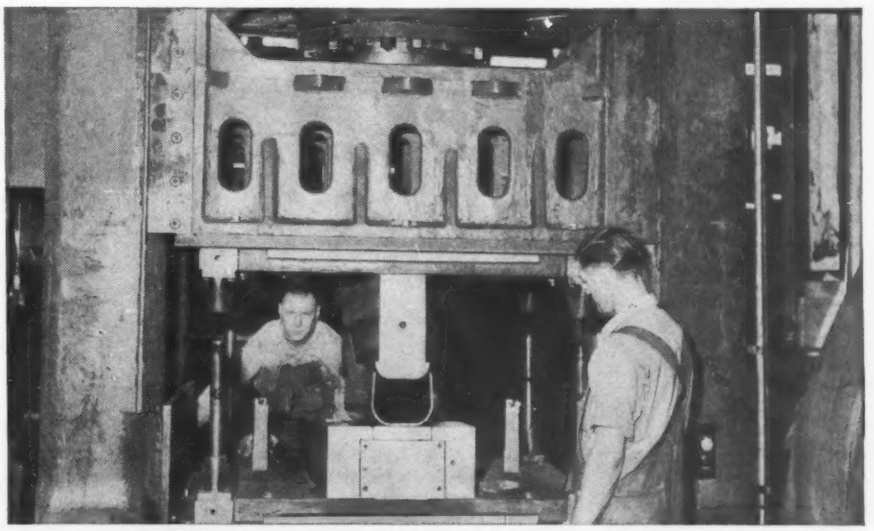
TIME SAVING
Hydraulic press does job in one operation.

COST SAVING
eliminates patterns, machine work, welding, expensive castings, complicated fabrication, cuts labor costs.

Lake Erie Hydraulic presses have made it possible to improve product quality and decrease manufacturing costs in hundreds of plants. It will pay you to study your production methods ...to determine if they can be performed better at less cost by modern Lake Erie Hydraulic Presses.



Locating a pedestal prior to forming. American Machine and Metals report that this Lake Erie Hydraulic Press can be set up quickly, is fast on production and has lowered manufacturing costs.



Formed pedestal about to be removed from press. The Lake Erie Press is extremely accurate, turns out uniformly high quality products and reduces rejects says American Machine and Metals.

Lake Erie Engineers, through their day-to-day contacts with leading manufacturers, have a wealth of up-to-the-minute information about methods for improving product quality and plant efficiency with hydraulic presses. This practical experience is available to you for the asking. Consult Lake Erie's Engineers today or write for latest bulletins on hydraulic presses.

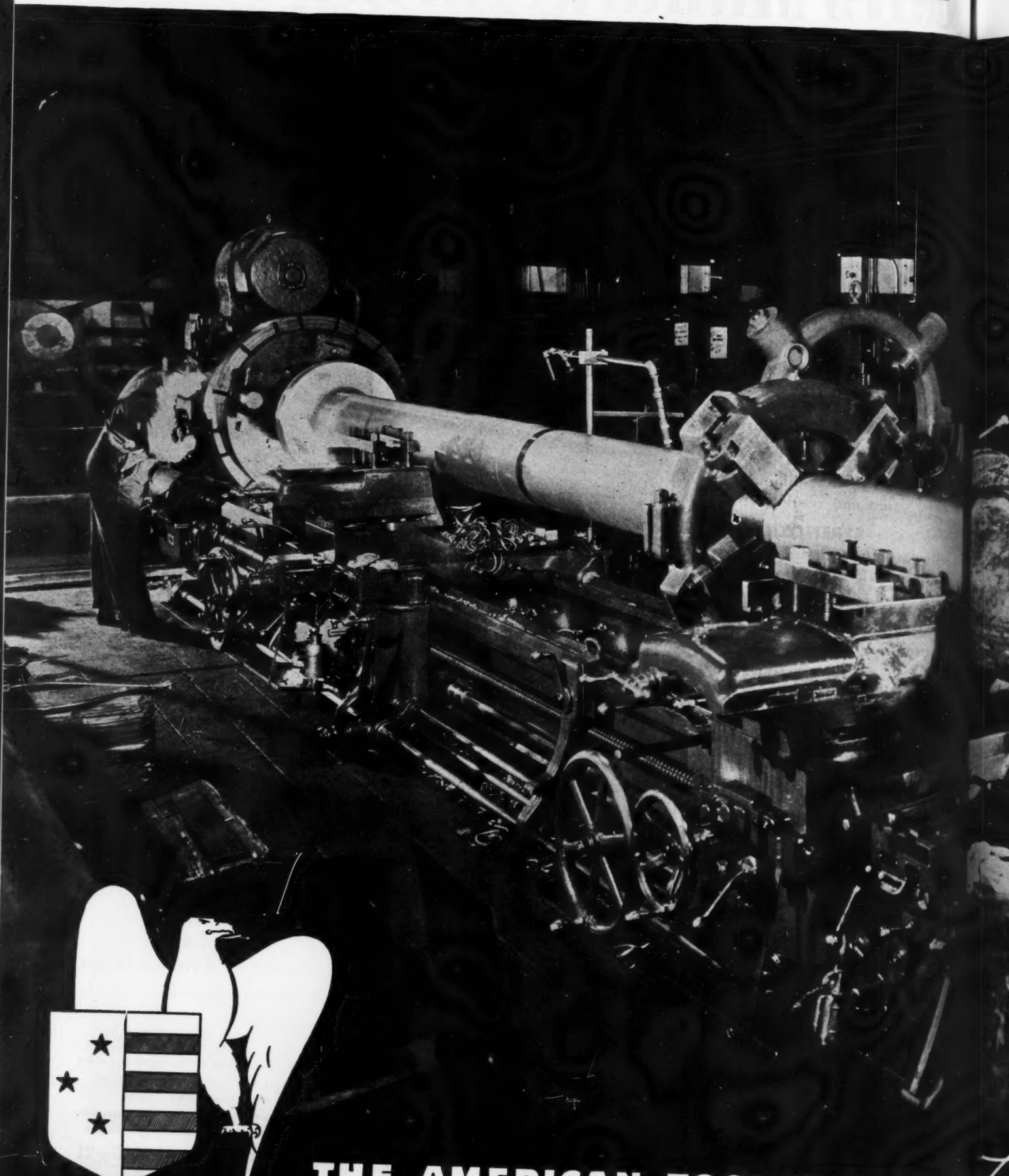
LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE
ENGINEERING CORPORATION
170 Woodward Ave., Buffalo 17, N. Y.

Offices in Principal Cities and Foreign Countries

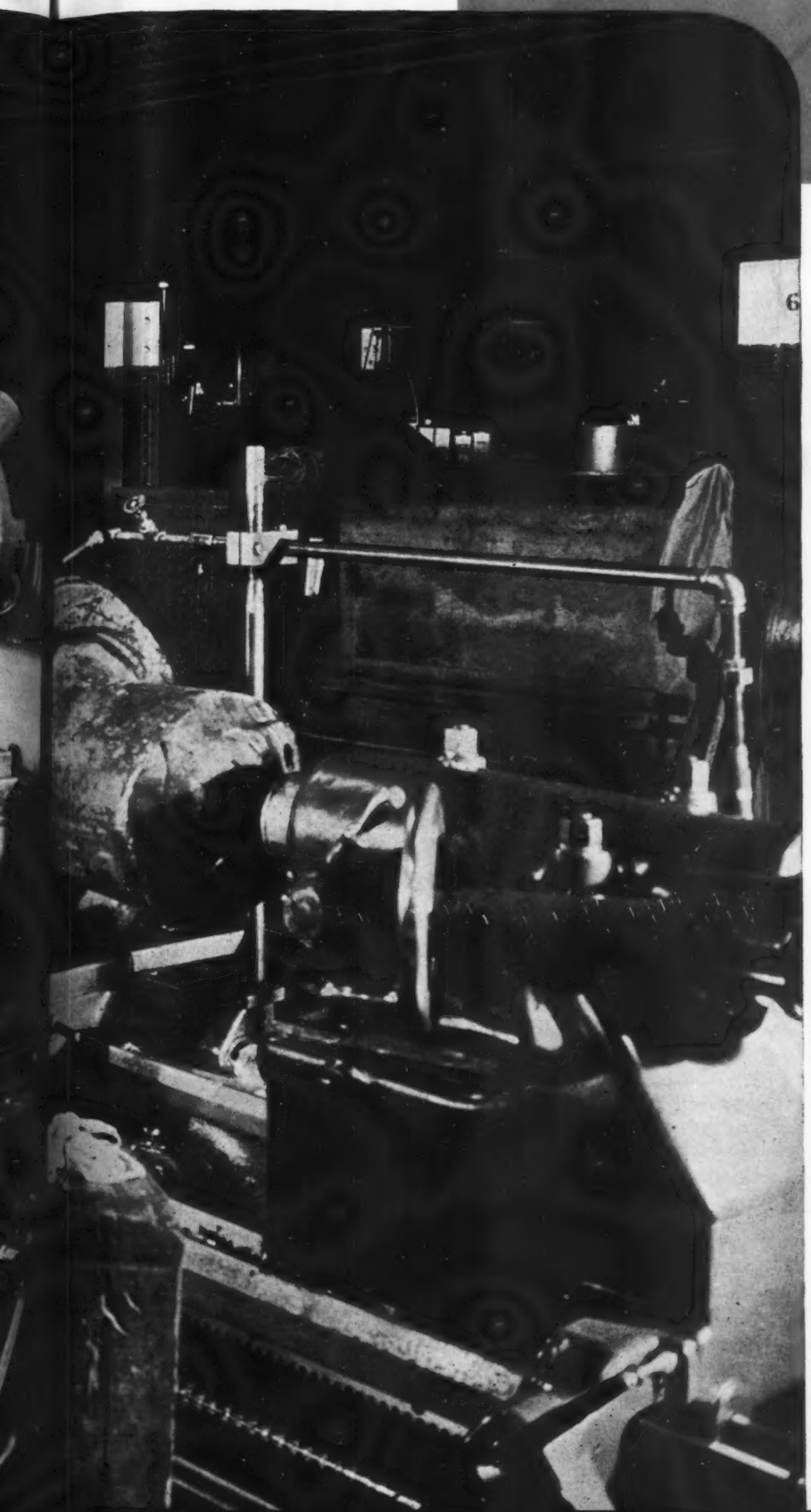
Leading manufacturer of hydraulic presses —all sizes and types—plastic molding... metal working... processing... rubber vulcanizing... stereotyping... special purpose.

PERFORMANCE



THE AMERICAN TOOL WORKS

FOR PROFIT



"American" Lathes from the largest to the smallest are ready and "all set" to meet every challenge of peacetime production. The power, stamina and endurance built into "American" Lathes are proving invaluable to many a plant in this highly competitive era.

Dependable service, minimum shutdown for failures and repairs, coupled with an almost unbelievable ability to "keep going" under any and all conditions, are genuine "American" characteristics.

"American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

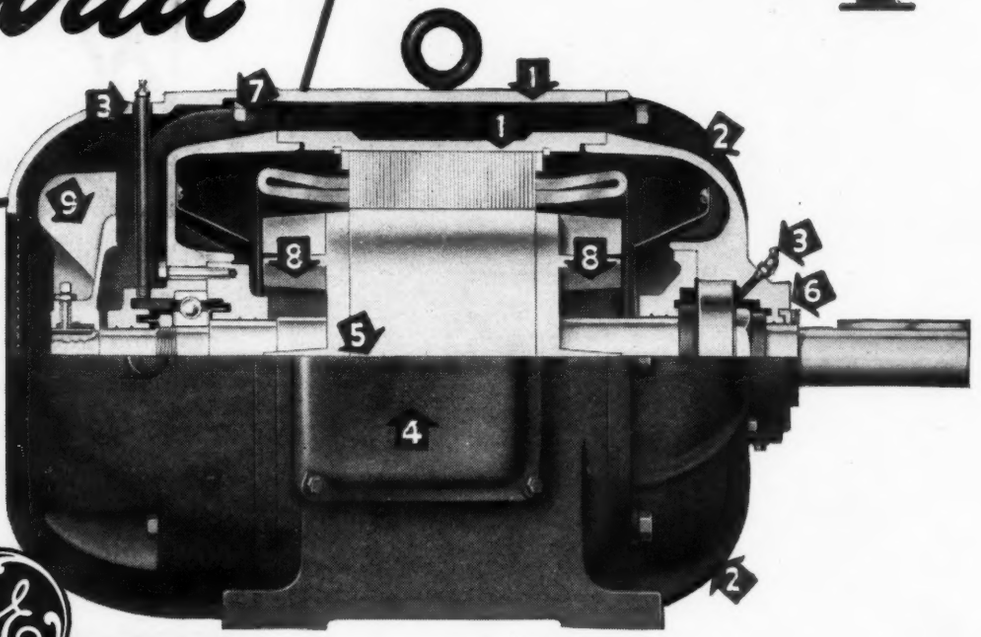
"American" Lathes are an asset in any plant.

• *Send for Bulletin No. 87*

Courtesy of Allis-Chalmers Manufacturing Co.

Lathes and Radial Drills **Cincinnati, Ohio U.S.A**

A Double Wall Keeps



TRI/CLAD

TOTALLY ENCLOSED STANDARD and EXPLOSION-PROOF MOTORS

These 9 points of new strength and serviceability put this TRI/CLAD totally enclosed motor way ahead.

1. A cast-iron, double-wall frame that completely encloses windings and punchings
2. Ribbed, cast-iron end shields, machined to provide a tight seal, yet easily removed
3. Well-proved, pressure-relief greasing system which can be packed with a long-life lubricant where advisable
4. Cast-iron conduit box diagonally split for wiring convenience (independently explosion-proof on explosion-proof motors)
5. Leads are sealed in a nonshrinking compound at the point where they emerge from the frame
6. Rotating labyrinth seal prevents infiltration of grit or liquids
7. Large, free-flowing, easy-to-clean air passages protect parts from accumulation of dust and foreign material
8. Modern "ageless" insulation treatment includes Formex* magnet wire
9. Powerful external fan is removable, simplifying maintenance (nonsparking type for explosion-proof motors)

AND IN ADDITION—compactness and short length promote ease of handling and installation

*Trade-mark reg. U.S. Pat. Off.

FOR THE COMPLETE STORY

Apparatus Department
General Electric Company
Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motor.

Please send me GEA-4131, "Motors and Control for Hazardous Locations."

Name.....

Company.....

Address.....

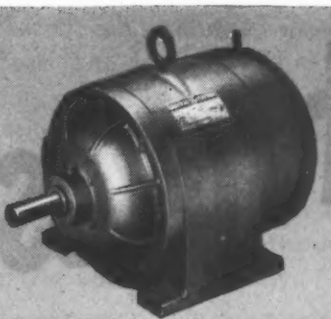
750-257-8080

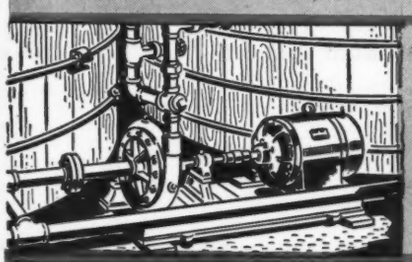
GENERAL ELECTRIC

Trouble Out

NEW TRI/CLAD TOTALLY ENCLOSED MOTOR IS MORE FULLY PROTECTED FROM DUST, DIRT, WEATHER, OR WHAT HAVE YOU...

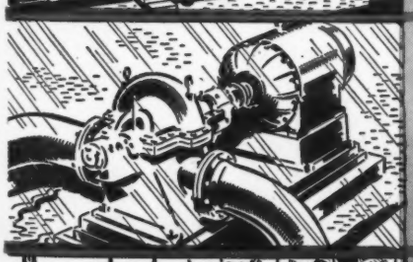
Now, General Electric has applied Tri-Clad construction to its line of totally enclosed induction motors (1 to 1000 hp) and to most of its explosion-proof motors as well. *Extra protection* has been raised another notch.





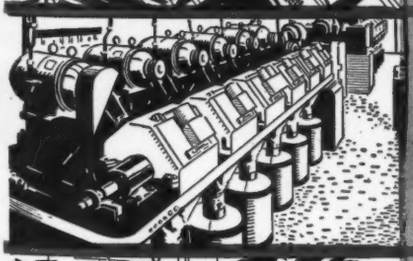
FOR EXTRA-SEVERE JOBS

Applications amid dust, metal filings, coolants, or corrosive agents—where totally enclosed motors have always been required—will now have the benefit of a stronger armor, plus convenience features that simplify installation and servicing.



FOR EXTRA-WET LOCATIONS

Indoors or out, these Tri-Clad totally enclosed motors will take hosings or heavy rains without danger of shutdown. The cast-iron frame is strongly resistant to rust and corrosion.

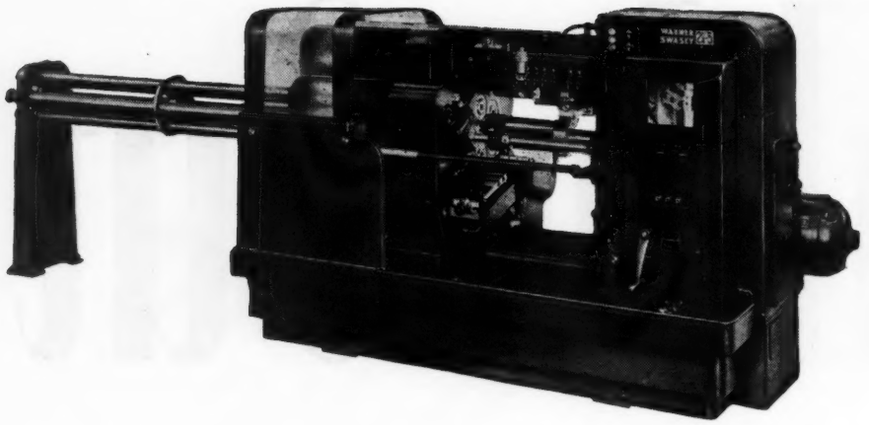


FOR HAZARDOUS ATMOSPHERES

"Companion motors" to the standard Tri-Clad totally enclosed, the new explosion-proof and dust-explosion-proof types are tested and listed by Underwriters' Laboratories for Class I, Groups C and D, and Class II, Groups E, F, and G.

FOR EXTRA-LONG LIFE

Many motor users are making the totally enclosed motor their standard for *all* jobs—based on evidence of long-term savings. This new member of the Tri-Clad line makes this decision more logical than ever.



Warner & Swasey Multiple Spindle Automatics

Now "automatic production" can be profitably applied to short and medium runs. New Warner & Swasey Bar and Chucking Automatics have the patented Quick-Set mechanism that eliminates cam changes and saves time in changing set-ups for different jobs so that small lots, as well as medium and long runs, are practical and profitable.

2 MODELS

5-Spindle Bar Machine, 1¾" Bar Capacity. (Can be furnished on order with oversize spindles to handle light work up to 2¼".) 5-Spindle Chucking Machine, 6" Swing.

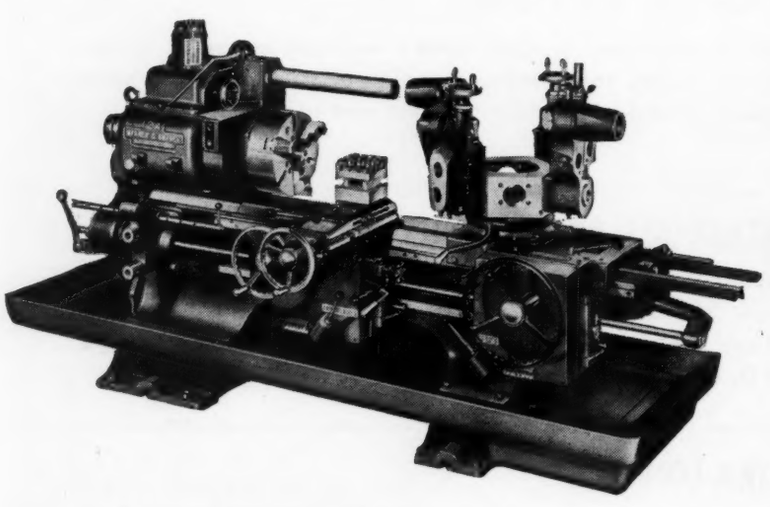
It takes less time to make

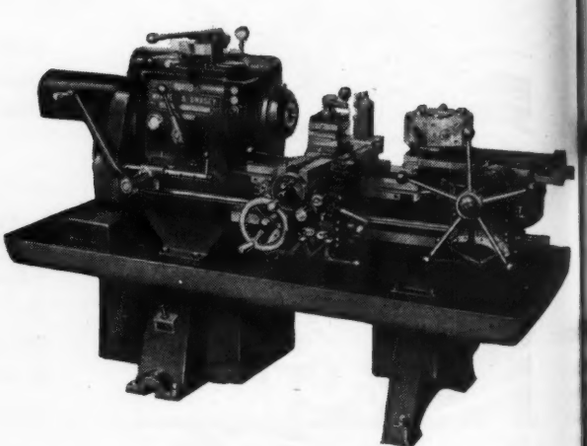
Warner & Swasey Ram and Saddle Type Turret Lathes

New Warner & Swasey Turret Lathes have many time-saving design improvements to bring you increased production at lower cost. They have greater power for taking heavier cuts under multiple tooling set-ups, at higher speeds, reducing floor to floor time. Their rigidity holds extreme precision on large chucking operations as well as on small parts to minimize scrap loss. Ease of handling decreases operator fatigue, making possible continuous high levels of output.

SADDLE TYPES

4 models, with bar capacities from 2½" to 12", swings from 16¼" to 28¼".

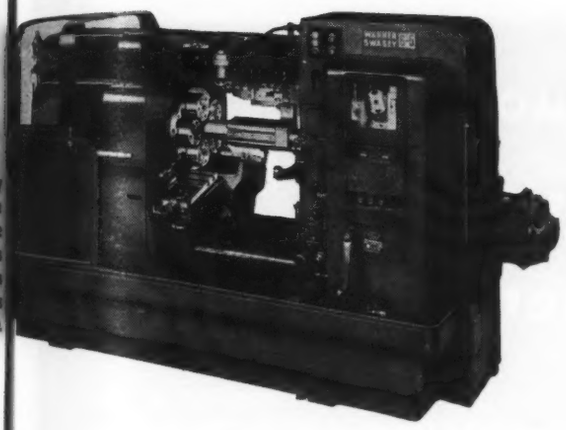




RAM TYPES

6 models, with bar capacities from 5/8" to 2½", swings from 11" to 20".

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS...



more money!

★ Why is it so difficult to maintain adequate margins of profit these days? No profound economic study is necessary to answer *that* question. It's simply that labor and material costs have risen, while in most instances rates of production have not.

Stepped-up production is the one solution to the problem—more goods completed at the end of each day—a working day often of fewer hours than formerly. Perhaps it can be done by speeding up manual effort. The sounder solution however is in giving workers better tools and machines so more work can be produced easier—in less time.

The new, improved machine tools built by Warner & Swasey provide ways to produce faster, more accurately and economically.

We sincerely believe we can help cut production time in your plant, either through new Warner & Swasey machine tools, or by suggesting new accessories for your present machines to increase their volume. Your nearest Warner & Swasey field office will be glad to discuss the subject with you; or write direct to Warner & Swasey, Cleveland 3, Ohio.

4 MODELS

No. 10 (Bench Model)—Capacity No. 0-80 to 10-24
No. 11—Capacity No. 8-36 to 7/8"
No. 11R Radial—Capacity No. 8-36 to 7/8"
No. 12—Capacity 3/8" to 2 1/2"

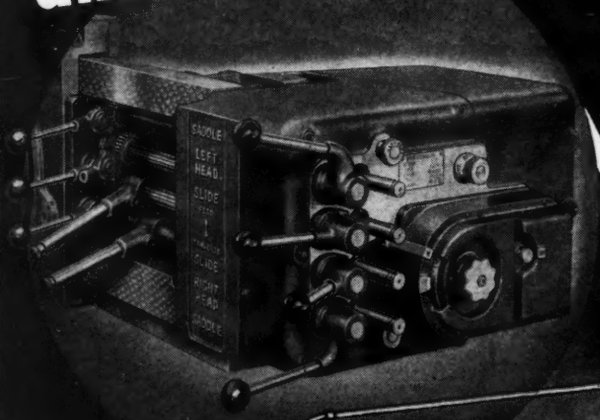
arner & Swasey Precision Tapping and Threading Machines

he new and radically different leading-on principle of Warner & Swasey recision Tapping and Threading Machines insures faster production of ass 3, 4 and 5 gage fits. Reduces tap breakage. Practically eliminates scrapng of pieces due to thread errors. Perhaps the increased productivity d ease of operation of these new Warner & Swaseys would make them good investment for your shop.

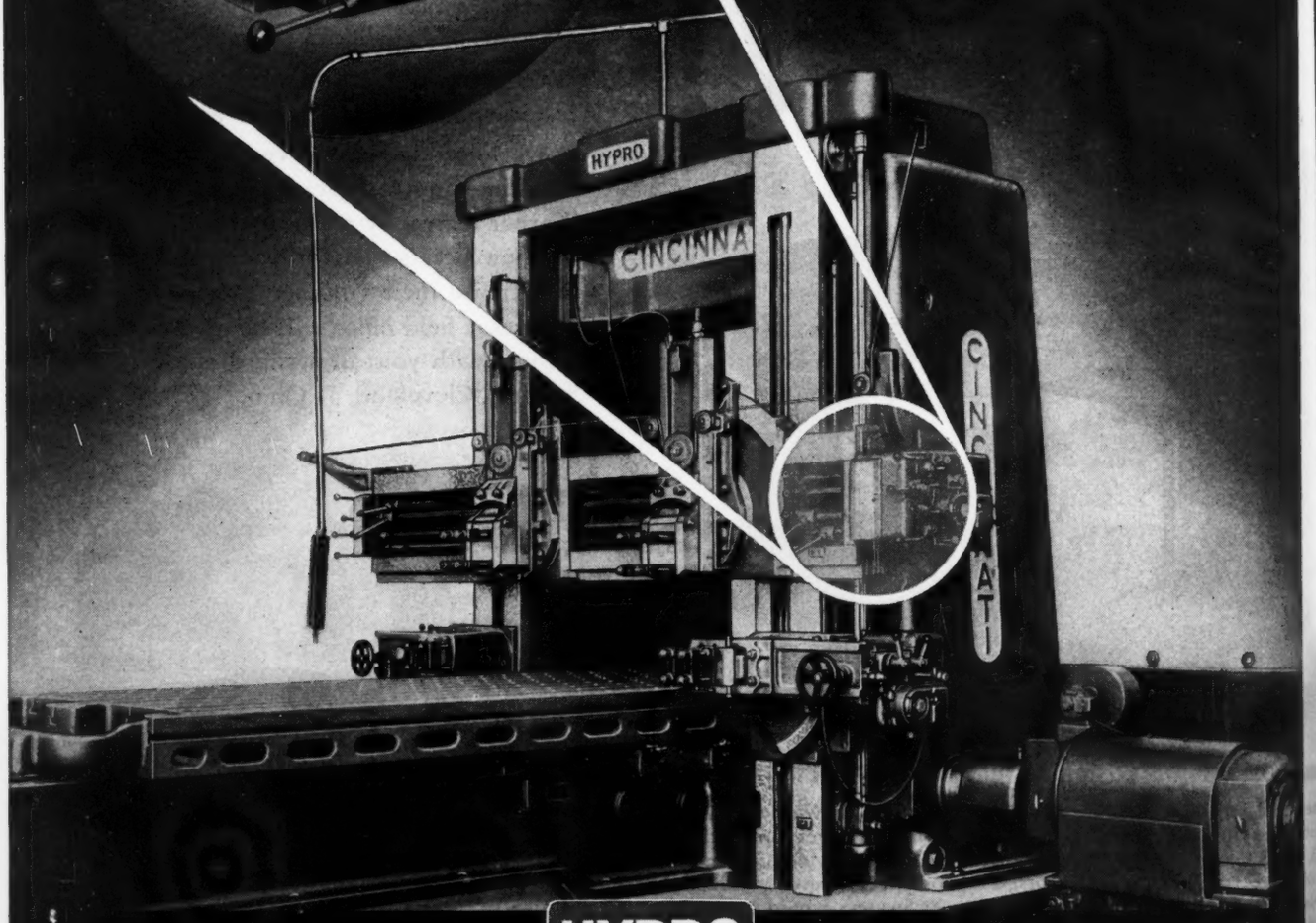
WARNER & SWASEY
Machine Tools
Cleveland

WITH A WARNER & SWASEY • TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

NOW WITH THE NEW, MORE EFFICIENT CINCINNATI Hypro Dual Saddle Control and Precision Adjustment Handles



. . . it is possible to engage or disengage independently the feed or rapid traverse of any saddle or slide of either rail head from both ends of the rail from the head itself or from the opposite head. The slideably mounted precision adjustment handles provide accurate manual adjustment of tool point location of either head convenient to the operator's position at all times.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS - BORING MILLS - PLANER TYPE MILLERS

CINCINNATI, OHIO

Want to ELIMINATE SMOKE in your shop?

Because it is a *chemical emulsion,* Cimcool CAN'T smoke. But that's not all. This radically new and different cutting fluid combines friction reduction and cooling capacity in a degree never before obtained.

CHECK ALL THESE ADVANTAGES!

- No fire hazard... No slippery film.
- Non-irritating... doesn't grow rancid.
- Faster cooling allows faster cutting.
- Uniform work temperature increases accuracy.
- Chemical lubricity increases tool life.
- Long lasting rust inhibitor included.
- Covers 85% of all metal working jobs.

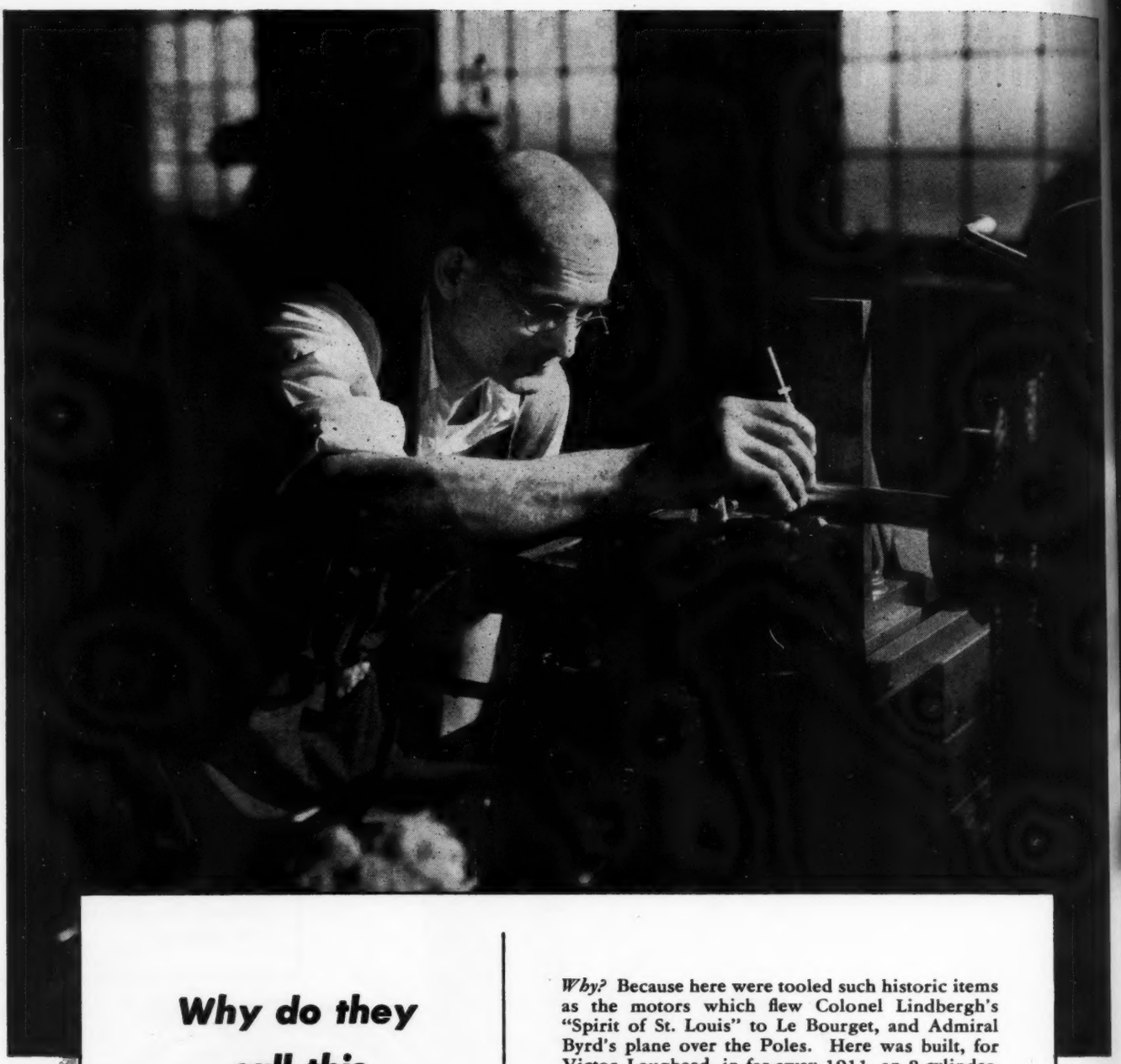
CIMCOOL DIVISION OF
THE CINCINNATI MILLING MACHINE CO.,
CINCINNATI 9, OHIO, U. S. A.

Copeland Refrigerator Corp.
***Did by Using* CIMCOOL.**

"Since using Cimcool, we have eliminated a very bad smoke condition which existed in the shop," writes The Copeland Refrigeration Corp. of Sidney, Ohio, and adds: "Cimcool has also eliminated a Monday morning odor. In addition, we find tool life has increased by approximately 150 percent."

CIMCOOL

THE MULTI-PURPOSE CUTTING FLUID



Why do they call this

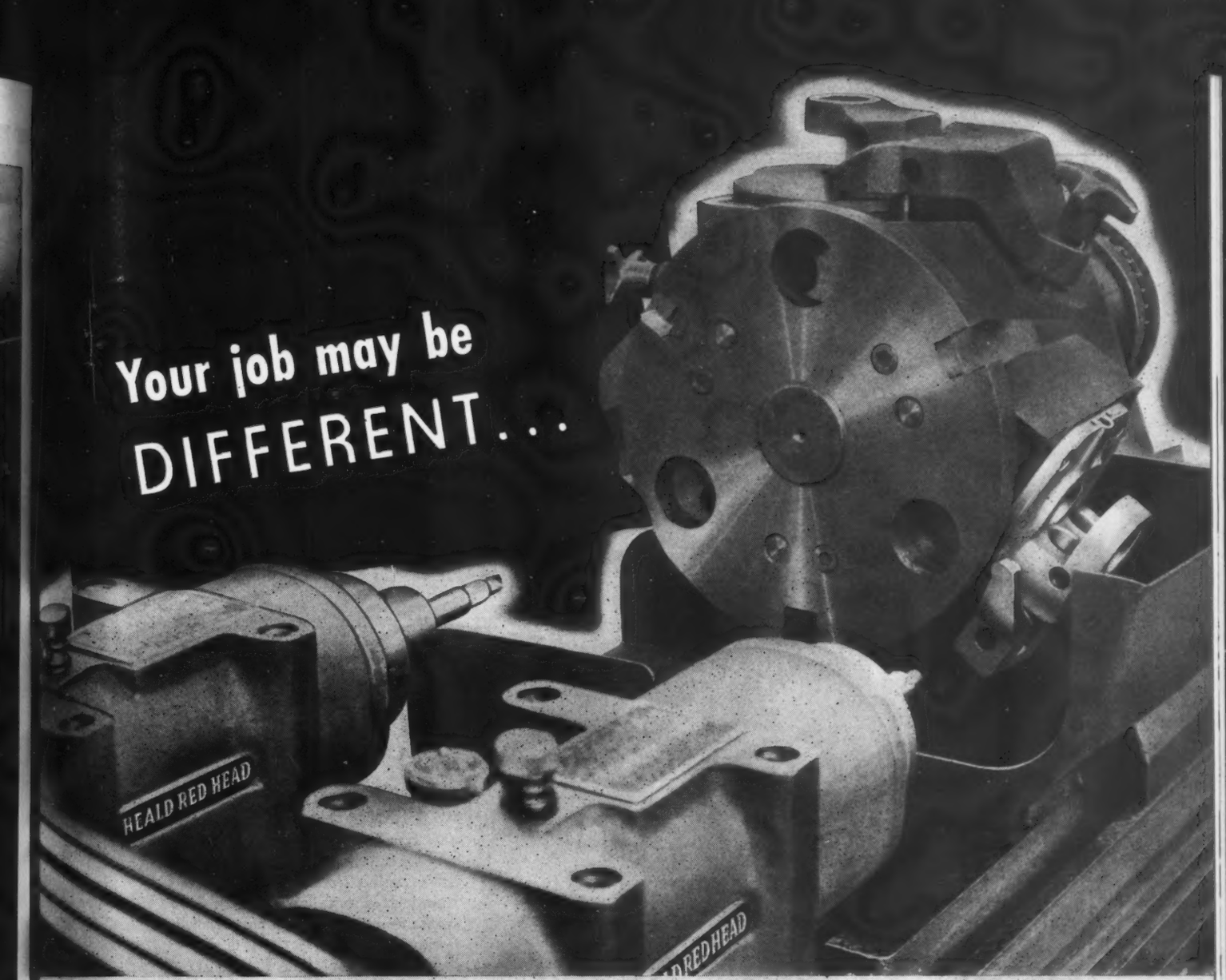
"The World's Most Famous Tool Room"?

Why? Because here were tooled such historic items as the motors which flew Colonel Lindbergh's "Spirit of St. Louis" to Le Bourget, and Admiral Byrd's plane over the Poles. Here was built, for Victor Lougheed, in far-away 1911, an 8-cylinder, experimental plane motor weighing all of 81 pounds, a forerunner of things to come. And here, too, were tooled the first visible-platen typewriter, the first punched-card tabulating machine, and many other famous "firsts." No other tool room has had experience of such breadth.

Today, as in the past, T-P master toolmakers can provide you with anything from a single jig to complete tool and gage set-ups for the most complex products of any type. And when you receive your T-P tools, they will require no fixing up, no grooming—*nothing*, except to be put to work immediately. For the full picture of Taft-Peirce Tool Room Service, write to: The Taft-Peirce Mfg. Company, Woonsocket, Rhode Island.

...for engineering, tooling, contract manufacturing:

TAKE IT TO TAFT-PEIRCE



But if it's precision finishing
Heald can help you do it better . . . at lower cost

In a sense, every precision finishing job is different—every one has its own peculiar requirements. The real problem today is—how to handle it *profitably* in the face of rising production costs. That's where Heald engineering can help to put you in a better competitive position . . . by designing the right equipment to meet your *specific* job requirements.

Here, for example, is how Heald engineers licked a time-consuming problem in the manufacture of refrigerator frames. They equipped the Bore-Matic shown above with special drills that bore, counterbore, chamfer and neck from the solid in two stations—roughing and finishing. Simultaneously, loading goes on at the top of a special rotary fixture which automatically positions the work during each cycle. Result: three separate and progressive stations are handled in the time and space formerly required for one!

It's engineering like this that makes the *real* difference on any job—the difference that pays off in accelerated production rates . . . greater machining accuracy . . . lower machining costs. Whether your operation involves a single machine or an entire plant full, Heald's staff of 200 engineers will be glad to show you new ways of getting improved, more economical production. For further information, write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision
. . . less cost

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

Brutes for Strength

1 ***Greatest Shock Absorbing Capacity*** of any type single-row bearing. Here's the secret: Norma-Hoffmann Precision Roller Bearings provide full line contact between rollers and races. That means you get, size for size, a maximum area to support shock load.

2 ***Handles Up to 50% Overload*** Full line contact, the design feature of these bearings, also provides ample margin for severe temporary overloads.

3 ***Lowest Coefficient of Friction*** under heavy load of any type bearing, plus unsurpassed speedability. These important benefits are a result of Norma-Hoffmann's 100% machined bronze retainer, precision workmanship and short, parallel roller design.

When the going is so tough no other anti-friction bearing will stand up—use Norma-Hoffmann Precision Roller Bearings. You will continue to get dependable service under critically severe conditions of speed, load, shock and vibration. These bearings are precision-made to unusually exacting tolerances and are backed by years and years of proved performance. Norma-Hoffmann Bearings Corporation, Stamford, Conn.

"NORMA-HOFFMANN"
Precision Ball, Roller and Thrust Bearings

FIELD OFFICES: NEW YORK, CHICAGO, CLEVELAND, DETROIT, PITTSBURGH, CINCINNATI, LOS ANGELES, SAN FRANCISCO, PORTLAND, ORE., SEATTLE, PHOENIX

YOU COULD TRY ALL THESE BUT...

here's a better way to answer cutting oil questions...

HAVE YOU ever thought of resorting to a soothsayer or Ouija board to get the answers to some of your puzzling cutting oil problems—at times, for example, when it seems that no cutting oil in the plant will give the right finish or reasonable tool life on a new machining or grinding operation? The easiest way, next to reading tea leaves—but a sure way to get the *right* answer—is to use Standard's Cutting Oil Service.

If your plant is located in the Midwest, there is an experienced cutting oil specialist at the nearest Standard Oil office. He's easy to reach and ready to study your cutting oil needs. He'll analyze just one job, or the operation of your whole plant, whichever you wish. There are two sound reasons why he can help you. First, he has complete knowledge of products developed by Standard Oil for practically all machining operations. Second, he has experience in applying these products in many other plants. You'll find Standard's Cutting Oil Service the real short cut to your cutting oil answers. Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

Standard's
CUTTING OIL
SERVICE

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING...STANDARD OIL COMPANY (INDIANA)...LUBRICATION ENGINEERING...STAND

Fewer oil changes... less deposit with improved

STANOIL

FOR 18 YEARS Standard has provided an oil containing additives to reduce oil oxidation and formation of acidity and deposits in turbines.

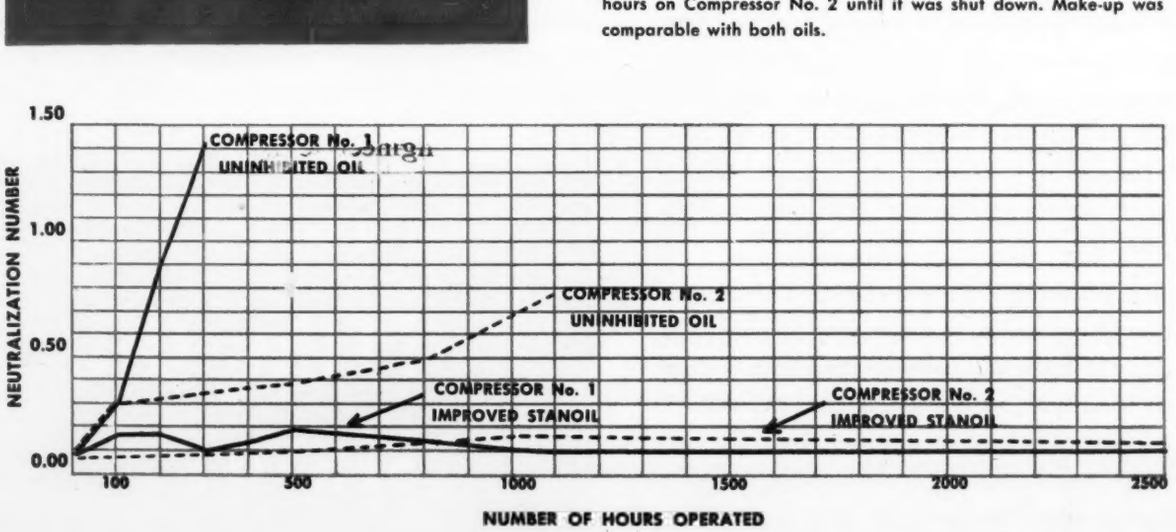
Now Standard has developed and incorporated in Stanoil an additive which improves oxidation resistance for a wide range of industrial applications. Improved Stanoil has been tested under the most severe operating conditions on many types of service: compressors, reduction gears, circulating and hydraulic systems.

Records of one of these severe tests in two compressors are charted below. They show the greatly reduced rate of acidity formation in Improved Stanoil as compared with oils previously used.

Try Improved Stanoil. Compare oil replacement records with the oil you now use in gear cases, circulating and hydraulic systems. Note how Stanoil reduces deposits in compressors.

A Standard Oil Lubrication Engineer will help you make a test. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

Adverse operating conditions and 24-hour a day operation imposed severe demands on the lubricating oil in two mine compressors. Conventional oil rapidly increased in acidity, as shown by the chart. Improved Stanoil maintained a safe low acidity throughout the 2500 hour test on Compressor No. 1 and for an additional 700 hours on Compressor No. 2 until it was shut down. Make-up was comparable with both oils.



STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

Prolong the life of your ball and roller bearings with these quality Gulf greases:

Gulf Anti-Friction Grease

FOR MODERATE AND HEAVY DUTY SERVICE

Gulf Precision Grease

FOR LIGHTER DUTY AND HIGHER SPEEDS

This machine, developed by Gulf technologists to evaluate the useful life of greases in lubricating ball and roller bearings, furnishes additional evidence of better lubrication with Gulf Anti-Friction Grease and Gulf Precision Grease.

BOTH laboratory tests and maintenance records in hundreds of plants prove that Gulf Anti-Friction Greases and Gulf Precision Greases are superior lubricants for anti-friction bearings. They have greater stability, a high melting point, maximum resistance to separation, and show minimum change in consistency in service.

Gulf-developed methods of compounding, employing special high-pressure kettles and mixing methods, produce these greases with a relatively smooth, nonfibrous texture.

Both of these superior anti-friction bearing lubricants are available in a broad range of N.L.G.I. consistencies. Call in a Gulf Lubrication Service Engineer today and ask him to recommend the proper type and grade for your every requirement. Or send the coupon below for further information.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices: **Boston · New York · Philadelphia · Pittsburgh · Atlanta · New Orleans · Houston · Louisville · Toledo**

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company M
3800 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, complete information on Gulf Anti-Friction Grease and Gulf Precision Grease.

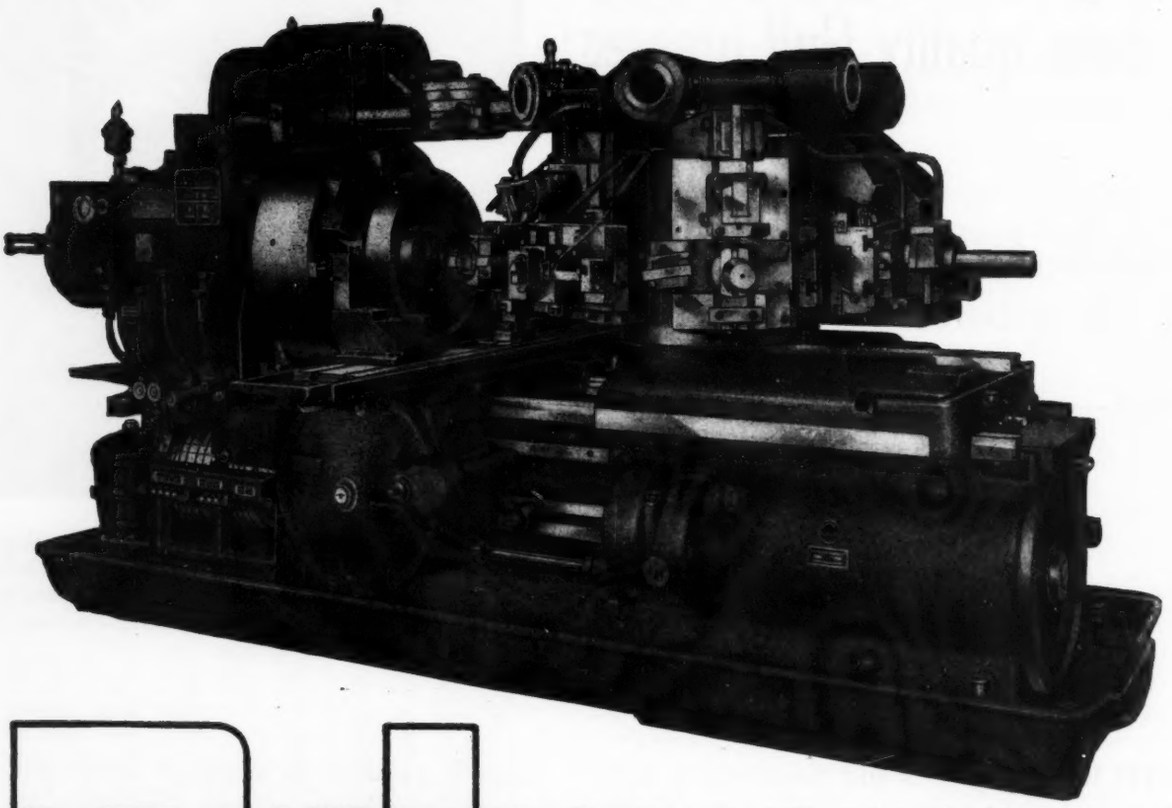
Name.....

Company.....

Title.....

Address.....

IF YOU NEED HIGH CAPACITY
CHECK THESE PRODUCTION *Facts*



The 8-DT and 8-DXT Automatic Chucking and Turning Machines have been designed to incorporate the advantages of high production and low labor costs into a machine of greater than ordinary capacity. Power, extreme rigidity, four automatic changes of spindle speed, three selective automatic changes of feed, automatic binding of the turret following index, direct cross slide action, electro-pneumatic clutch operation and a constant, motor-driven high speed motion of cross slide and turret slide are features which contribute to maximum production. And, because one operator usually handles a complete battery of machines, greater labor savings are realized.

BULLETIN 112

A digest of the important production facts concerning 8DT and 8DXT Automatics is given at the right.. A study of these facts will indicate that the 8DT or the 8DXT machine can be used profitably in your large-part production. Send for further details and complete specifications as found in Bulletin 112.

POTTER & JOHNSTON M

N CHUCKING AND TURNING,
BOUT P&J 8DT and 8DXT AUTOMATICS

BASE UNIT

Ways are solid blocks of hardened and ground steel, clamped in position by means of alloy steel bolts and then ground in place. Base itself is of heavy box section construction.

HEADSTOCK

All headstock gearing is of special alloy steel with spiral formed teeth. All shafts are mounted on anti-friction bearings. Spindle is made of high carbon steel forging, mounted on oversize precision ball bearings.

SPEEDS

20 Changes of speed between 7 and 160 R.P.M. are arranged in five sets of four automatic changes. Any group may be readily obtained through pick-off gears.

CROSS SLIDE

New design, with tandem cam drums directly under slide. Ball bearing cam roll studs are mounted in cross slide, furnishing a direct connection. Cam drums easily accessible for special cams.

TURRET SLIDE

Rigidly constructed and provided with hardened and ground steel inserts to form its bearing on the ways. Turret is automatically clamped after indexing. Six turret faces are standard. Four or five faces are available when specified.

FEEDS

Feed gearing is driven from the spindle, causing the feed to vary directly with spindle speed. 24 feeds are arranged in geometric progression from .003″ to .119″ or from .003″ to .0355″ per spindle revolution, as specified. A feed from each of three groups may be selected for automatic feed changes. SPEED AND FEED CHANGES—Operated automatically through dogs or by hand control. Solenoid-controlled valves time the flow of air which actuates the cylinders which, in turn, control the automatic operation of the clutches.

SPECIFICATIONS:

	8DT (up to and including serial 80607)	8DXT	8DT (starting serial 80608)	8DXT
Turret Travel	32″	32″	32″	32″
Turret Dwell	13″	13″	13″	13″
Turret Feed	16″	16″	16″	16″
Travel of Turret to Start of Index	31½″	31½″	31½″	31½″
Turret Slide Adjustment	10″	20″	8⅜″	18⅜″
Cross Slide Adjustment	10″	25″	8⅜″	23⅜″
Swing over Bed Ways	36″ Dia.	36″ Dia.	36″ Dia.	36″ Dia.
Max. Cross Slide Travel and Feed Each Way	6¼″	6¼″	6¼″	6¼″
	(other combinations of cross slide travel and feed are obtainable with special cams.)			
Swing over Cross Slide	23″ Dia.	23″ Dia.	23″ Dia.	23″ Dia.

N MACHINE CO., PAWTUCKET, RHODE ISLAND

HILL "Open Side" Hydraulic Vertical Spindle Grinder (Size 18" x 18" x 60")

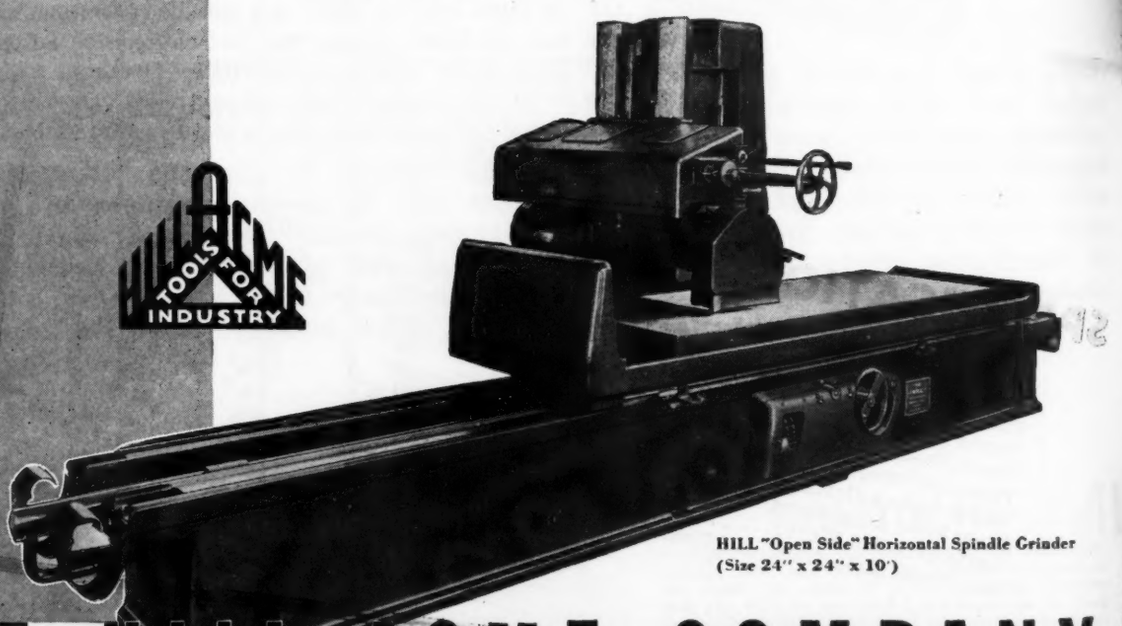
THE NECESSITY OF PRECISION!

The acquired habit of precision in war—*precision* bombing, *precision* navigation, *precision* timing, *precision* production—will carry on.

Industry will be satisfied with nothing less, and precision grinding will make your products as accurate in peace as they were in war.

The advantage of increased production with lowered cost is assured through precision when surfaces are finished on a HILL "Open Side" Hydraulic Surface Grinder.

Made in both Horizontal Spindle and Vertical Spindle design, there is a size to meet every requirement of heavy duty precision grinding.



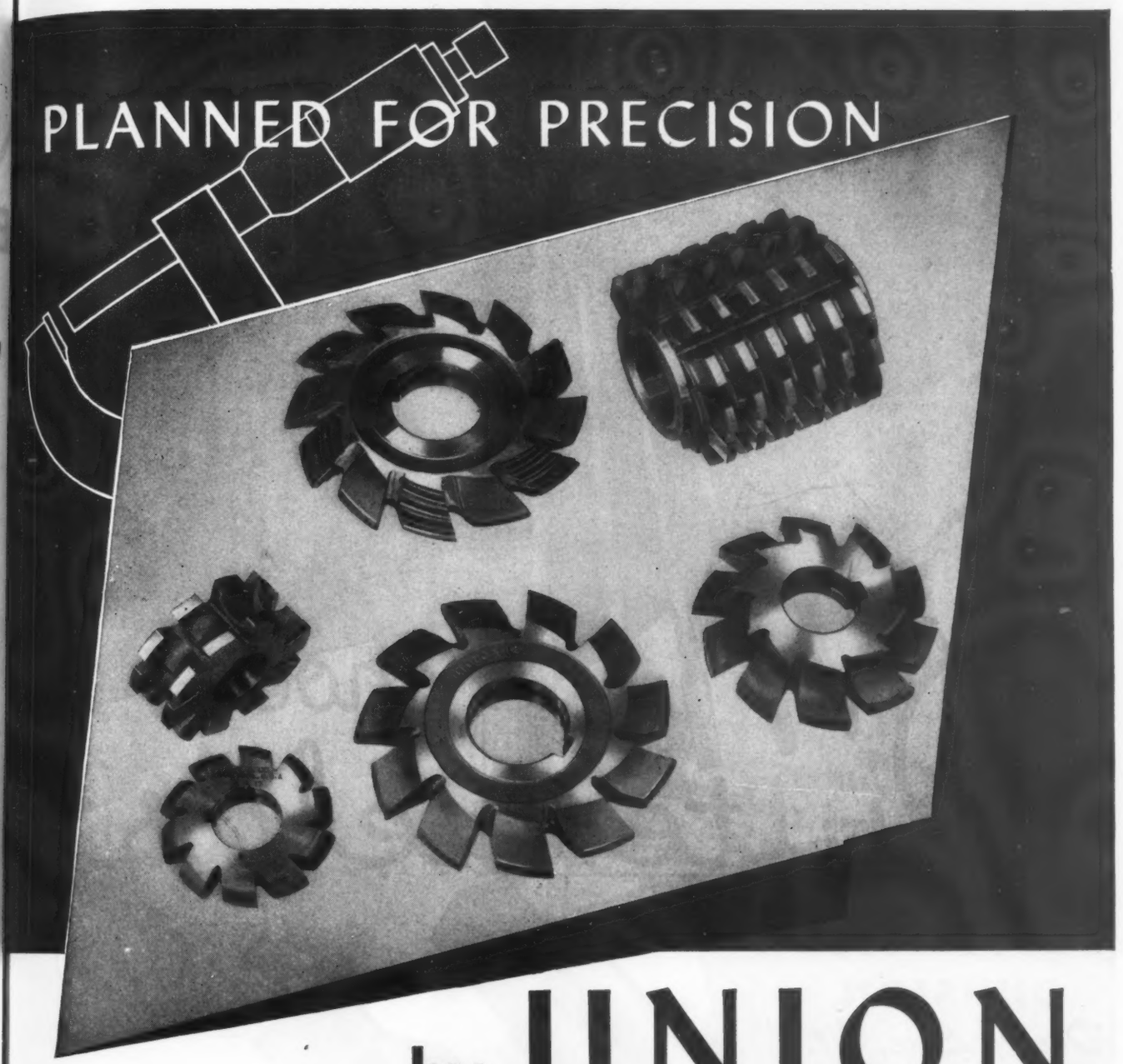
HILL "Open Side" Horizontal Spindle Grinder (Size 24" x 24" x 10')

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

6400 BREAKWATER AVENUE • CLEVELAND 2, OHIO

"HILL" HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING • TAPPING MACHINES
"CANTON" ALLIGATOR SHEARS AND PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES AND SHEAR BLADES



...by UNION

Any job which requires high precision also requires careful preliminary planning. Union has helped with an important part of your planning . . . by designing tools which will produce the precision results you want – under production pressure.

UNION TWIST DRILL CO., ATHOL, MASS.

STORES:

New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 5527 Woodward Ave.
San Francisco: 121 Second St.
Los Angeles: 524 E. Fourth St.
Seattle: 568 First Ave., South

UNION ★ BUTTERFIELD ★ CARD Divisions of the Union Twist Drill Company

S. W. Card Mfg. Co. Div.—Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec

for profitable peacetime production choose
Butterfields!
BUTTERFIELD DIVISION
Derby Line, Vt.
Rock Island, Que.
STORES: New York, 61 Reade St. —Chicago, 11 So. Clinton St.— Cleveland, Hal. W. Reynolds, 3346 Superior Ave.—Detroit, 5527 Woodward Ave.—Los Angeles, 524 E. Fourth St.—Toronto, 137 Wellington St., West—Montreal, 111 St. Paul St., West—Winnipeg, David Phillip Agencies, Ltd., 213 Bannatyne Ave.—Vancouver, 327 Shelly Bldg. Agents for Great Britain: Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S.E.11, England. Branches in Birmingham, Manchester, Glasgow, Newcastle-on-Tyne, and Bristol.

CARD

free-cutting spiral-pointed

HAND TAPS

Card Spiral Pointed Hand Taps are designed for tapping through holes or blind holes when drilled deeply enough. Correctly used, these Taps produce a smooth, free-cutting action which results in excellent, accurate threads.

FORCING THE CHIPS *ahead* OF THE TAP

Above is a detailed view of chip-action produced by Card Spiral Pointed Hand Taps. Long, curling chips are forced ahead of the Tap, avoiding clogging, increasing strength of Tap, reducing breakage.

S. W. CARD MFG. CO.

Mansfield Mass.

STORES:
New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 5827 Woodward Ave.
San Francisco: 121 Second St.
Los Angeles: 536 E. Fourth St.
Seattle: 568 First Ave., South

How SPEED SAVES MONEY

A production record like this is a challenge to any plant that turns out precision parts in large quantities.

Here is a steel Bearing Race, 3¼ x 4⅝", turned from SAE 4620 Tubing. Close concentricity must be held between outside contour and the bored and reamed inside diameter.

An Acme-Gridley 4¾" Four Spindle Bar Automatic does the complete job in less than 1½ minutes machine time.

We suggest you compare that with the time it would take to do this job on equipment you now have. More important, if you want a modern-method time estimate on producing a special job of your own, write us about it.

Modern-method time saving is certainly one of the answers to your price competition and larger volume of sales.

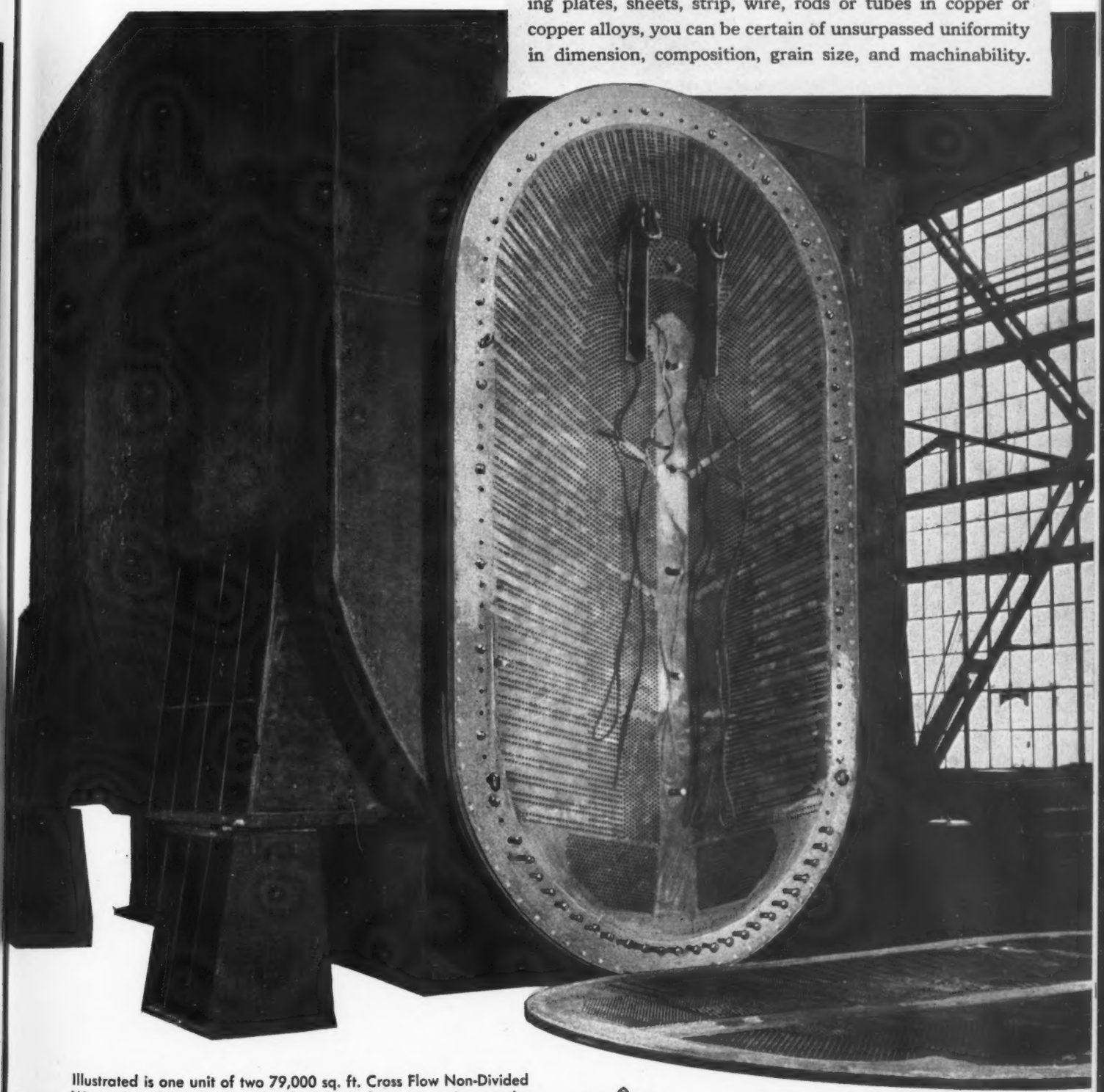
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

An unusual job, these 14,000-pound Anaconda Muntz Metal Plates

But . . . you can expect the unusual in brass mill performance and technical cooperation from The American Brass Company. Furthermore, by specifying "Anaconda" when ordering plates, sheets, strip, wire, rods or tubes in copper or copper alloys, you can be certain of unsurpassed uniformity in dimension, composition, grain size, and machinability.



Illustrated is one unit of two 79,000 sq. ft. Cross Flow Non-Divided Water Box Type Surface Condensers under construction at the Carteret, N. J. Plant of the Foster Wheeler Corporation for installation at the Southwark Electric Generating Station of the Philadelphia Electric Co. The 1-1/2"-thick Anaconda Muntz Metal Tube Plates, measuring 11'7" x 21'1" and weighing approximately 14,000 pounds each, were supplied by the Detroit Branch of The American Brass Company. 12,316—27/32" tube holes and 108—1-5/8" bolt holes were drilled in each plate. See the following page.

ANACONDA

Anaconda

COPPER & COPPER ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

talking about the machinability of Brass...

Depth of hole, 3″

Drill Size, 27/32″

Speed, 2200 r.p.m.

Feed, .015″

Drilling Time

6 SECONDS!

See the preceding page for a description of these 14,000-pound Anaconda Muntz Metal (60% copper – 39.5% zinc – 0.5% lead) Condenser Tube Plates. The photo below was taken in the shops of Foster Wheeler Corporation.

The 1-1/2″-thick plates were clamped together for drilling 12,316–27/32″ matched tube holes. Yet, so uniform was the metal in machinability that hole after hole—in all parts of the 11′7″ x 21′1″ plates—was drilled in 6 seconds. 46159

ANACONDA
from mine to consumer

Anaconda

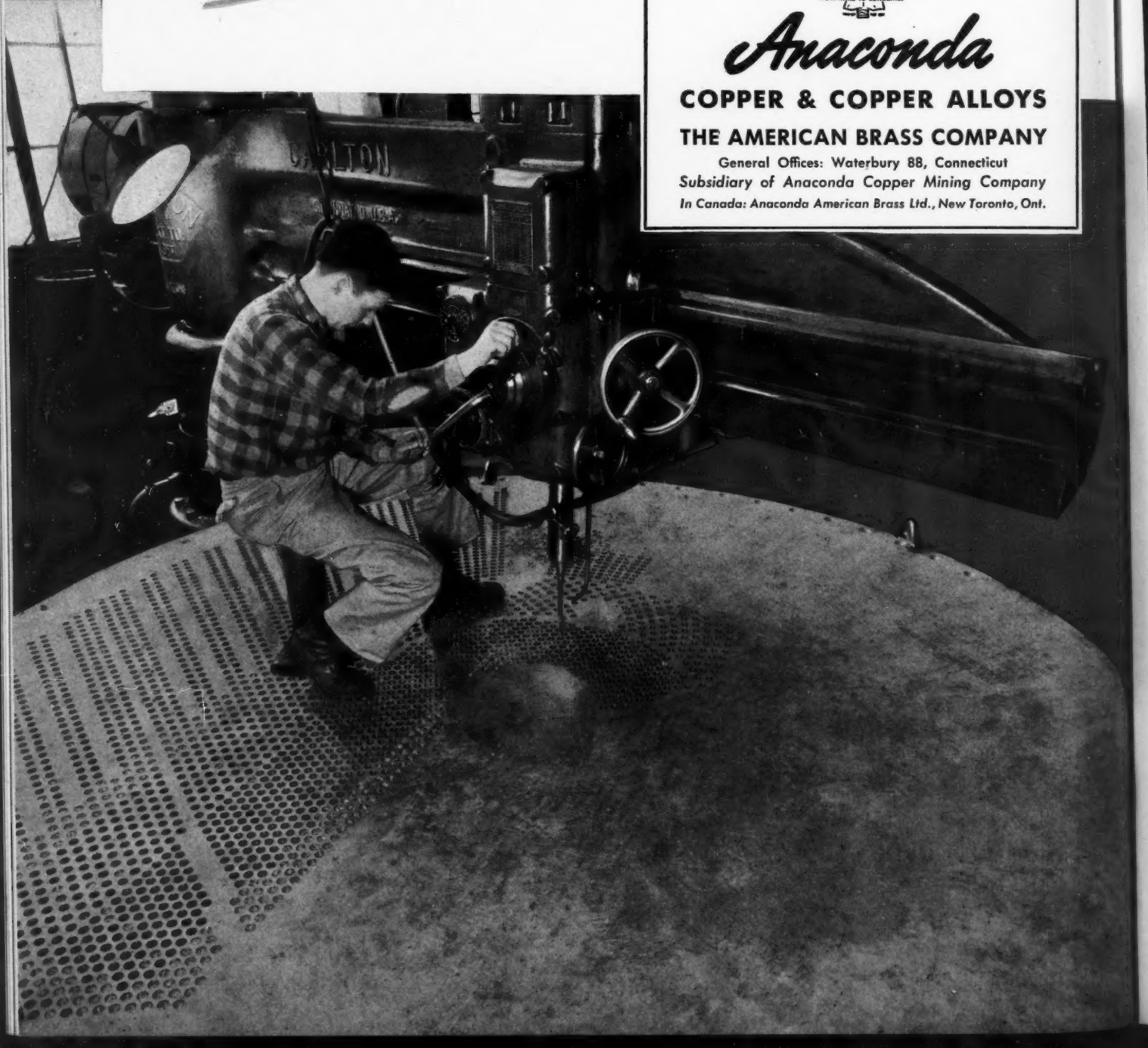
COPPER & COPPER ALLOYS

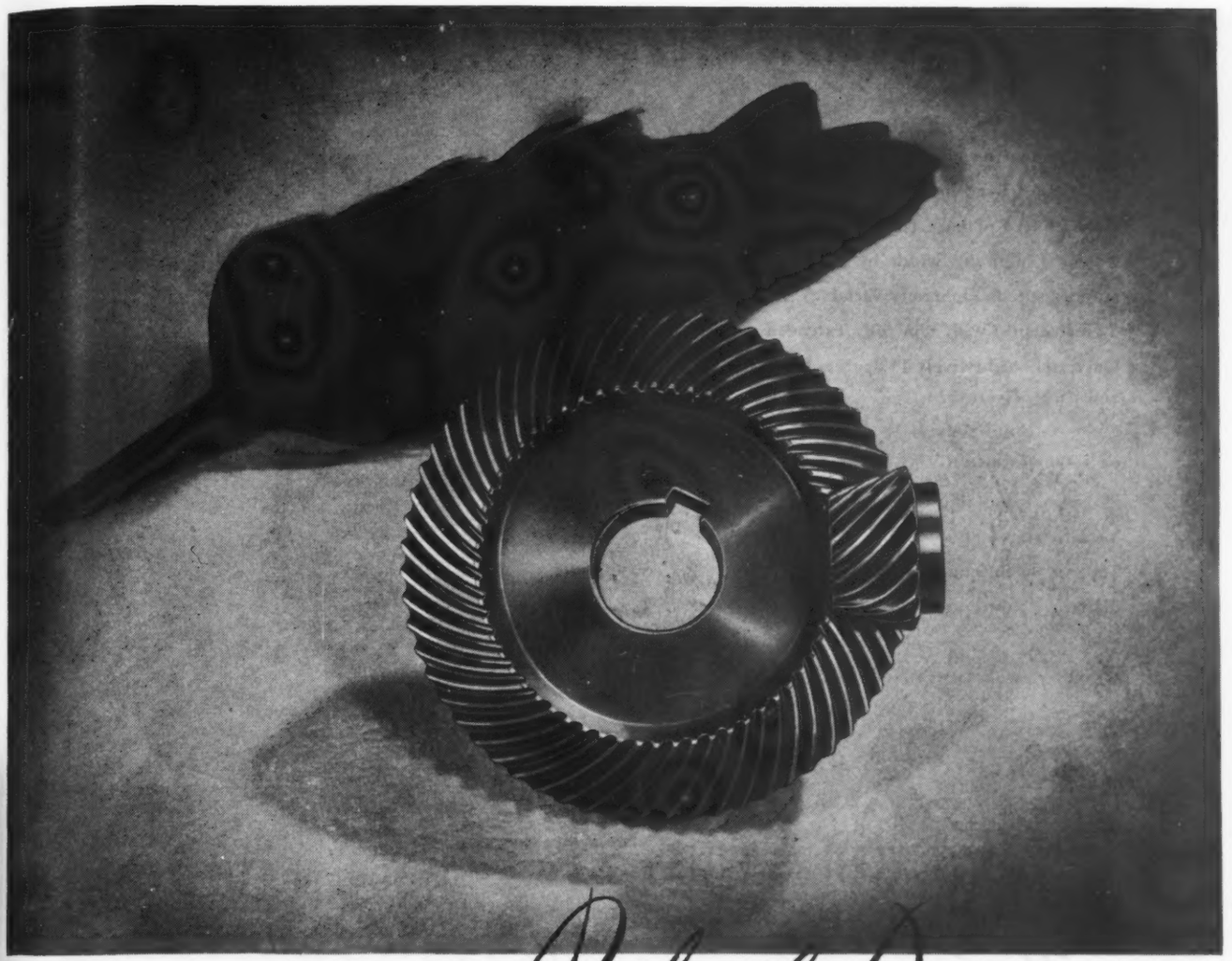
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.





BOTH ARE *Perfectly Designed* FOR THE JOB THEY HAVE TO DO

Like the feather designed by nature, Gears by G.S. are highly efficient components. They are designed with the greatest possible skill and precision to function smoothly, quietly, and economically for years. Type of gear, choice of proper material, best and least costly method of production . . these and all other factors affecting the custom-building of the finest Fractional Horsepower Gears are familiar subjects to our gear *specialists.* You are well advised to submit Small Gear problems to our competent engineers. Their friendly counsel incurs no obligation.

FRACTIONAL HORSEPOWER GEARING

GS

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

8 REASONS WHY...

1. Longitudinal feed (hand or "electronic" power) . 27"
2. Cross feed (hand or "electronic" power) 20"
3. Vertical feed of knee (hand) . . 16"
4. Table: Length by width by thickness 32 x 22 x 4"
5. Spindle speeds (infinitely variable) 90-2200 R.P.M.
6. Throat depth, with ram fully extended . . . . . 30"
7. Universal head swivels 45 degrees front and back of vertical.
8. Universal head swivels 30 degrees left or right of vertical.

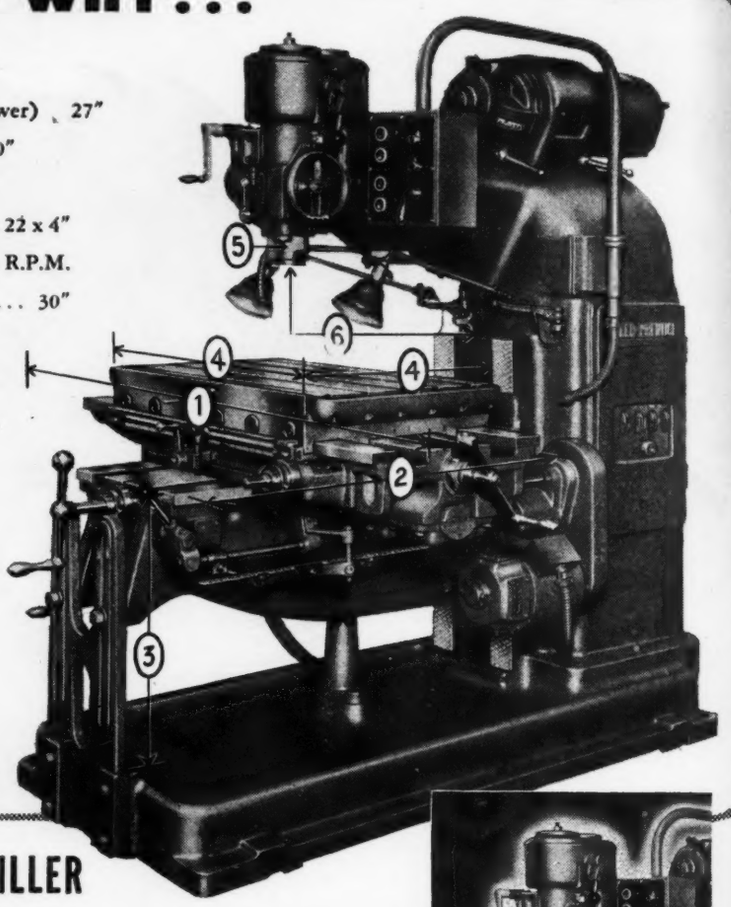
Horizontal ram adjustment (hand) 16"

Vertical travel of spindle . . . . . 5"

Taper hole in spindle NMTBA #40

Electronic power cross or longitudinal feeds . . . . . ½"-40" per min.

Weight — with power feed 6,750 lbs.

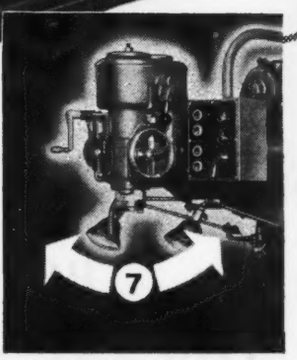


The 22-V UNIVERSAL HEAD VERTICAL MILLER and DIE SINKER

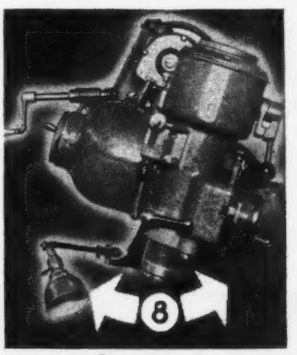
. . . will give you greater RANGE!

Here are PLUS values! The Reed-Prentice 22-V has EXTRA efficiency . . . is adapted to an exceptionally wide range of work! Quicker too — because the combination of the universal head and the infinitely variable feeds and spindle speeds permit milling, drilling and boring operations with only one set-up!

These features save time and cut costs. The machining of plastic and rubber molds, die casting dies, forge dies, or jigs and fixtures is faster with the adjustable swivel head, electronically controlled cross and longitudinal power feeds and attachments available for high speed milling and slotting. For extra utility in the toolroom — investigate the 22-V NOW! Write for complete information to Dept. B.



Universal head swivels 45° front and back of vertical.



Universal head swivels 30° left and right of vertical.

ARMY NAVY

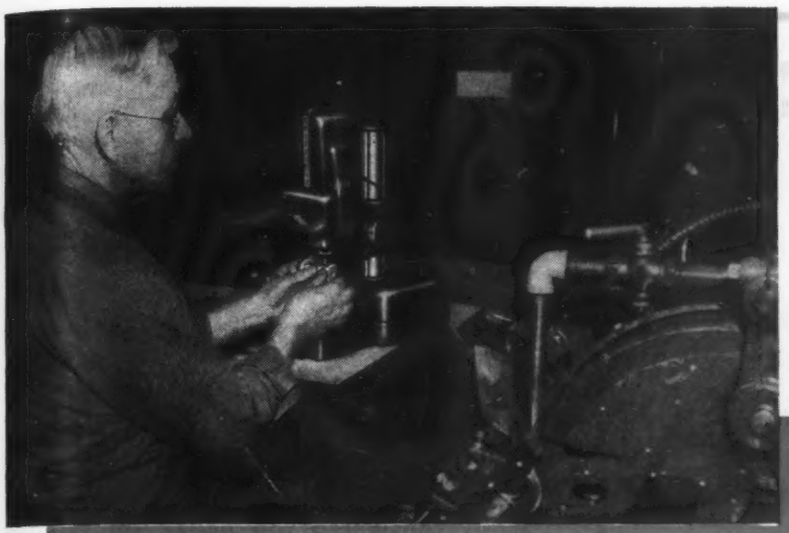
MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

NEW YORK OFFICE:
75 West St., New York 6, N. Y.

CLEVELAND OFFICE:
1213 W. 3rd St., Cleveland 13, Ohio.



"Measuring at the Machine"

MINIMIZES PRODUCTION LOSSES!

Reducing production LOSSES means reducing production COSTS. LOSSES usually occur at the machine—stopping such losses brings down costs.

"Measuring at the Machine" brings the following advantages which contribute to being able to sell a product profitably at or under competitive prices:

1. When accurate gaging is practiced right at the production machine, scrap losses have been reduced as much as 80% and 90%.
2. "Measuring at the machine" practically eliminates salvage work which is nearly always costly.
3. Component parts reaching the assembly line fit quickly and easily—no assembly time lost. Instead of working to the high limit as an operator normally does, he works to hit the part "on the nose."
4. When high production gaging instruments like the Multichek, Precisionaire and Visual Gage are used at the machine, the floor space devoted to inspection operations, gage maintenance costs and the labor cost of inspection are all greatly reduced.
5. Under close dimensional control, finished products give maximum performance, greater service life, and help build prestige for the manufacturer.
6. Fewer parts will wear out in service, and then replacement is quickly and easily done—no laborious fitting in the field will be necessary.

chek with Sheffield on "Measuring at the Machine"

1767

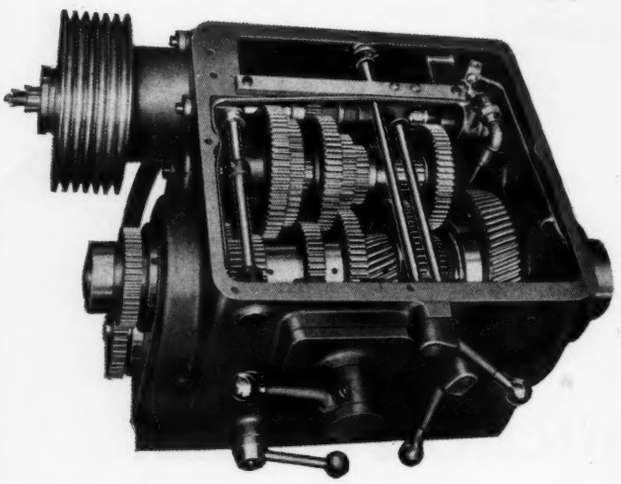
SHEFFIELD PRECISION CRAFTSMANSHIP

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U. S. A.

MACHINE TOOLS...GAGES
MEASURING INSTRUMENTS
CONTRACT SERVICES

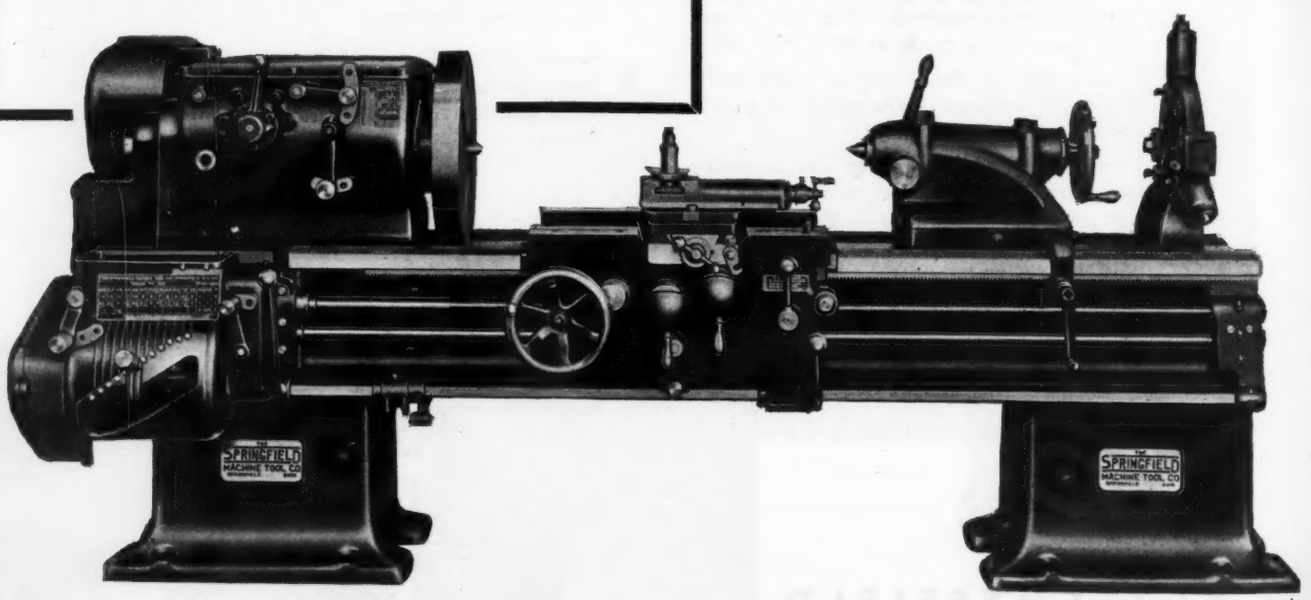
SPRINGFIELD GEARED HEAD LATHES—



THE HEADSTOCK is powerful, rugged, compact and easily operated. All gears, providing 16 speeds, are forged from the best grade chrome-molybdenum steel, heat-treated, with GROUND teeth. All shafts are splined. Only one positive clutch is used—between back gear and direct drive. Oil spray system assures dependable lubrication over all gears and into all bearings.

POWERFUL . . . . . YET EASY TO OPERATE

The Springfield 20" Super Duty Lathe is powerful, yet easy to operate . . . able to produce precision results on work normally considered too heavy for regular 20-inch lathes. Throughout its design—in bed, head, tailstock, carriage and apron — liberal dimensions assure the ruggedness necessary to make high precision possible on the heaviest work. Bed and all heavy castings are made of chrome-nickel semi-steel. The heavy carbon chrome-moly steel spindle is accurately ground and mounted on Timken precision bearings. Thus, Springfield Lathes are capable of taking on the most difficult machining jobs — and producing precision results profitably.



SEND TODAY FOR BULLETIN NO. 159

THE SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD, OHIO

Braze it for 4¢ with TOCCO

Willey's Carbide Tool Company, Detroit, reports the following benefits from TOCCO *Induction Brazing* of tool tips:

1. *Large lathe tools:* **8 times as fast.** *TOCCO brazes 85 per hour; former method 80 per day.*
2. **Cost cut from 58¢ to 4¢** *for each large tool.*
3. *Small tools (¾" to ¼" square):* **TOCCO brazes 250 to 400 per hour.**
4. *Two 15-KW TOCCO machines* **paid for themselves in three months.**

Mail coupon for information on New Low Cost TOCCO 7½ KW machine . . . ideal for brazing and other heating applications.

THE OHIO CRANKSHAFT COMPANY

FREE BULLETIN

TOCCO

Mail Coupon Today

THE OHIO CRANKSHAFT CO.
Dept. M • Cleveland 1, Ohio

Send Bul. 16 on New Low Cost TOCCO 7½ KW machine for brazing and other heating applications.

Name.....
Position.....
Company.....
Address.....
City .....Zone... State.....

Engineered Hole Location Service Speeds New Dies to Your Pressroom

BRINGS INTERCHANGEABILITY TO TOOLMAKING

Die, stripper and punch plates of complex tools and dies can now be produced *concurrently* by several toolmakers on an interchangeable parts-and-assembly basis instead of progressively as a one-man job.

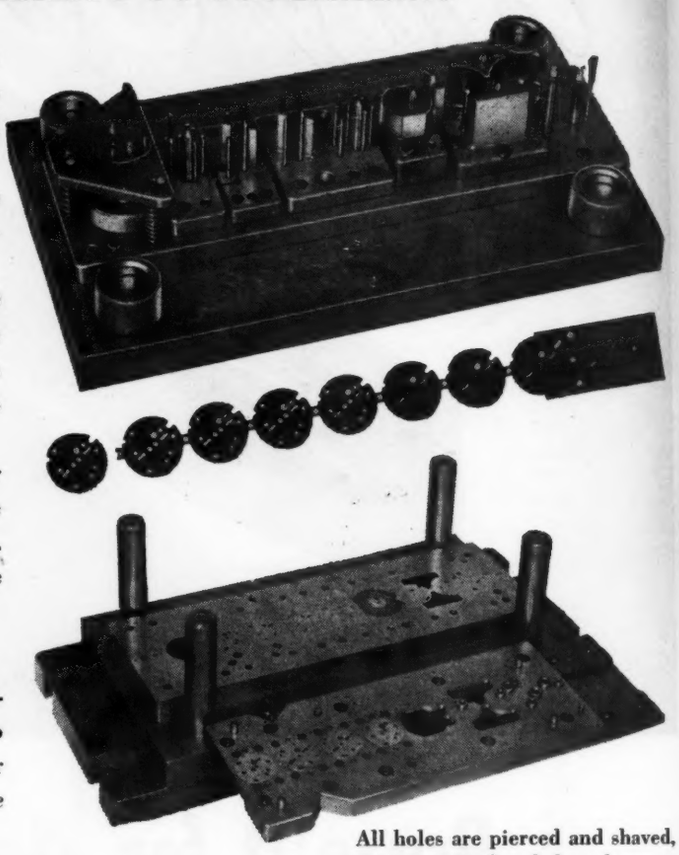
Yes, mass-die production is now possible, with the Moore Jig Borer and Moore Jig Grinder working together as tool room partners.

Take this 10-station hardened progressive die, with 100 holes to be located, bored and ground to .0002″ tolerance in the die and stripper inserts. Using old methods, this would require about 2,000 man hours and six months to complete.

With the Moore Jig Borer and Moore Jig Grinder working to pre-engineered dimensions, all parts of the die were manufactured *to figures instead of to "fit"*... bored and ground in single set-ups on each machine. The diemaker merely assembled the parts.

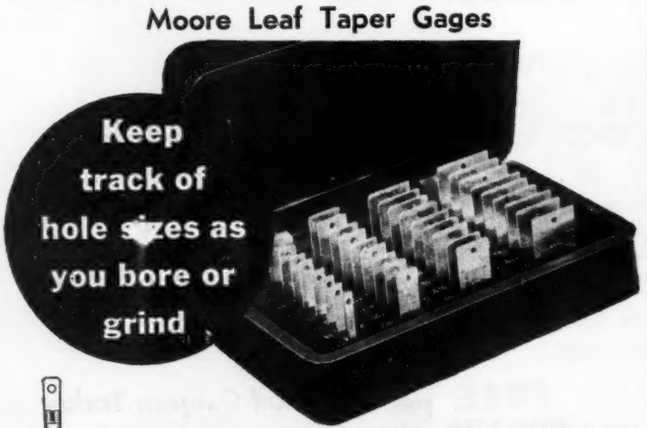
Total man hours: 1,000, Delivery: 5 to 6 weeks

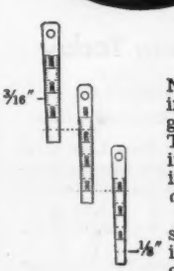
Mass-die production lowers tool costs, increases toolroom capacity, prolongs tool life and extends the ratio of productivity of operator and machine. One of our engineers will show you how Moore *Engineered Hole Location* fits your production scheme.



All holes are pierced and shaved, contour gutted and shaved.

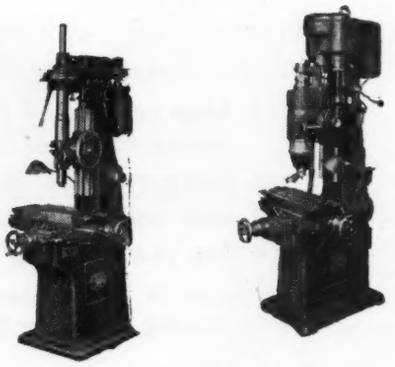
Moore Leaf Taper Gages





Now you can be sure of the *exact* size of trial cuts in bringing a hole up to size during boring or grinding. With a set of Moore *Direct Reading* Leaf Taper Gages, any hole size can be measured in infinite increments from .095″ to 1.005″. Simply insert the gage in the hole and read its diameter directly from the gage.

Each leaf in the complete set of thirty-six is a separate tool, accurate to .00025″. It may be used individually without interference from any other gage. Graduations on each size overlap the next by .010″...enable measuring of counterbored or shouldered holes as well as the bottom of through holes to check for bellmouth or taper. Write today for detailed literature.



MOORE JIG BORER
MOORE JIG GRINDER

MOORE TOOLS

MOORE SPECIAL TOOL COMPANY, INC.
734 UNION AVENUE BRIDGEPORT 7, CONN.

Taps 40% more holes per day

THIS fabricator of railway cars had been using universal electric and old-style piston type air drills for tapping operations. Tools often stalled and broke the tap. "Why not use a modern Rotor air drill?" suggested the Rotor Application Engineer. These lighter, more powerful drills were tried and installed. On such work as running 1″ taps through ½″ steel plate and into a steel casting, these tools gave these results:

40% more holes tapped per day by same two-man crew due to greater power of Rotor drill and easier handling because of lighter weight.

Reduced tap breakage because Rotor drill runs smoothly . . . does not stall.

Pays for itself in 3 months due to increased production and reduced tap breakage.

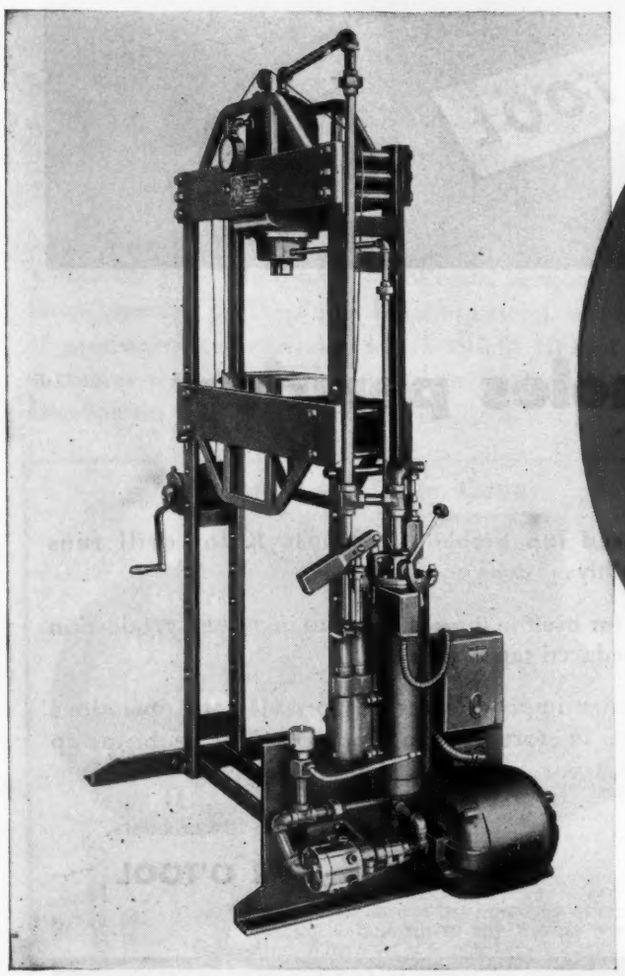
Similar improvements in portable tool operations may be in store for you if you put your problems up to the Rotor Application Engineer.

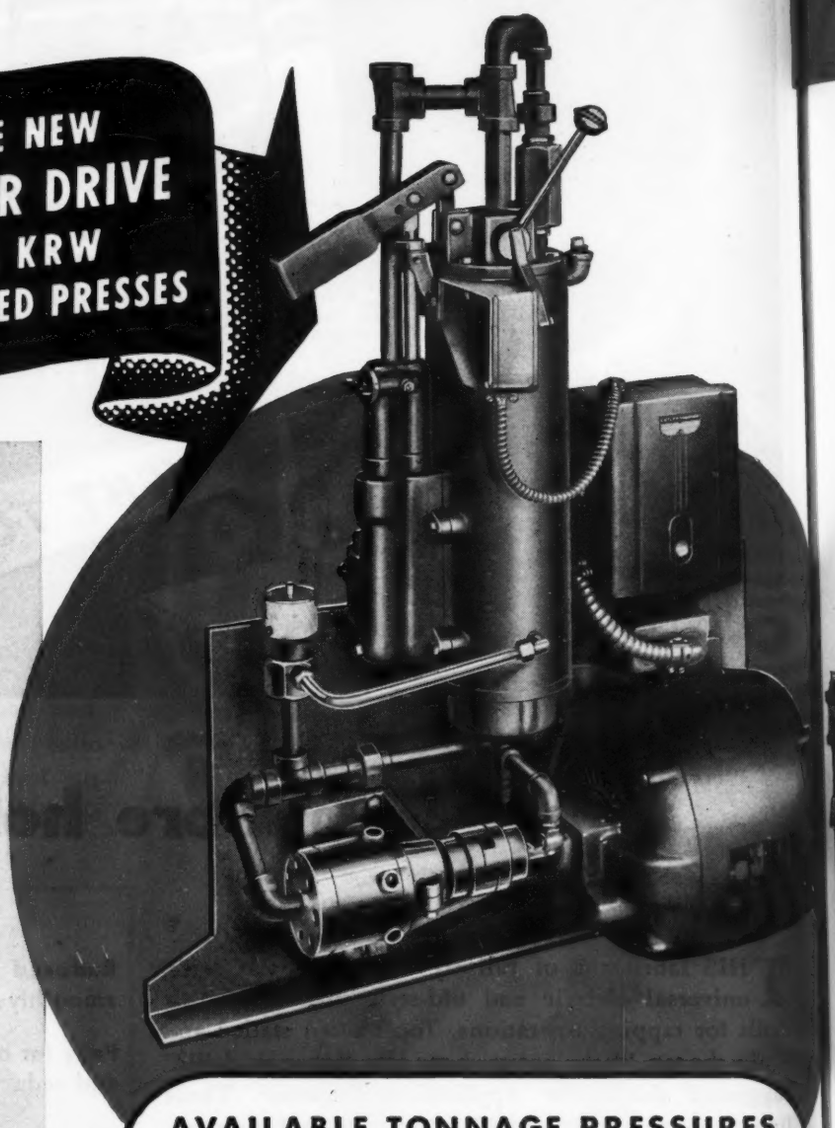
Yours for lower costs,

AIR O'TOOL

Now...Modernize

THIS IS THE NEW
KRW MOTOR DRIVE
THAT FITS KRW
HAND OPERATED PRESSES





This is a Standard KRW Press Equipped with MOTOR-DRIVE

Illustration shows how the compact motor-drive unit is connected to a standard KRW hand-operated hydraulic arbor press. Complete installation data is supplied with all units.

AVAILABLE TONNAGE PRESSURES
25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

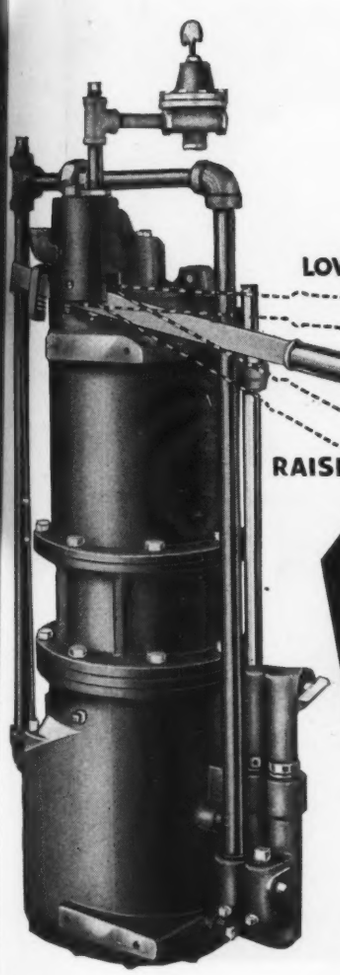
AIR PRESSURE	9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder
	25 to 51 Tons	33 to 68 Tons

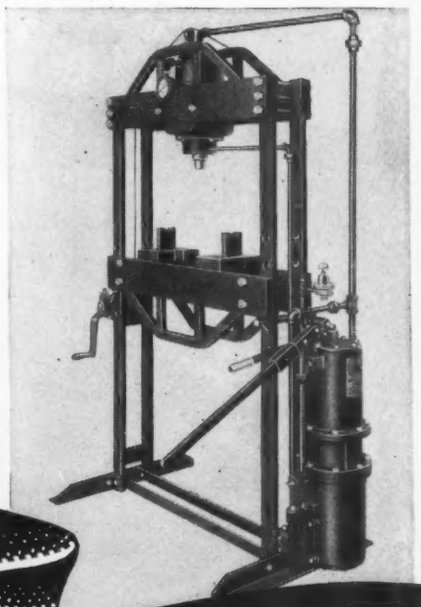
KRW Motor Drive develops up to Full Capacity of any KRW Hand-Operated Press.

YOUR KRW ARBOR PRESSES

FOR HIGH PRODUCTION WITH EITHER AIR-OIL OR MOTOR-DRIVEN POWER UNITS

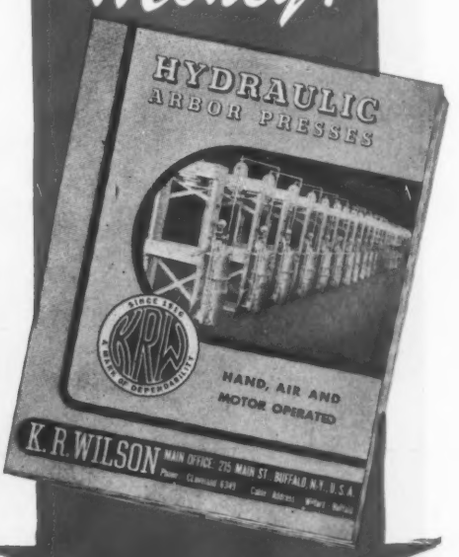
● Thousands of standard KRW Hydraulic Arbor Presses can now be power equipped for production use by adding the new KRW Power Units. These units . . . either air-oil or motor-driven . . . are available for 25, 50, 60 and 75-ton KRW standard presses. When power equipped, and utilizing simple, inexpensive dies, these standard presses are adaptable to a great many bending, forming, stamping and straightening operations . . . relieving heavier and more expensive equipment for other work. Either type power unit is easily attached to the press. Adding the unit in no wise affects the famous KRW two-speed hand pumping feature . . . press can still be hand-operated. Study the specification table shown here in terms of your work-pressure and motor needs. Give us the serial number of your KRW press and electric current requirements and we will quote you price and quick-delivery date. Put your idle or infrequently used KRW hand-operated Arbor Presses to work where they will pay big dividends . . . on your production line.





THIS IS THE **NEW** KRW AIR-OIL DRIVE THAT FITS STANDARD KRW HAND OPERATED PRESSES

THIS NEW CATALOG WILL SAVE YOU *Money!*



K. R. WILSON
215 MAIN ST., BUFFALO 3, N. Y.

K. R. WILSON, 215 Main St., Buffalo 3, N. Y.
Please send me complete information on

- ☐ KRW Air-Oil Power Units
- ☐ KRW Motor-Drive Power Units

15

Serial number of our KRW Press is.....

Voltage..... **Cycle**..... **Phase**.....

Firm.....

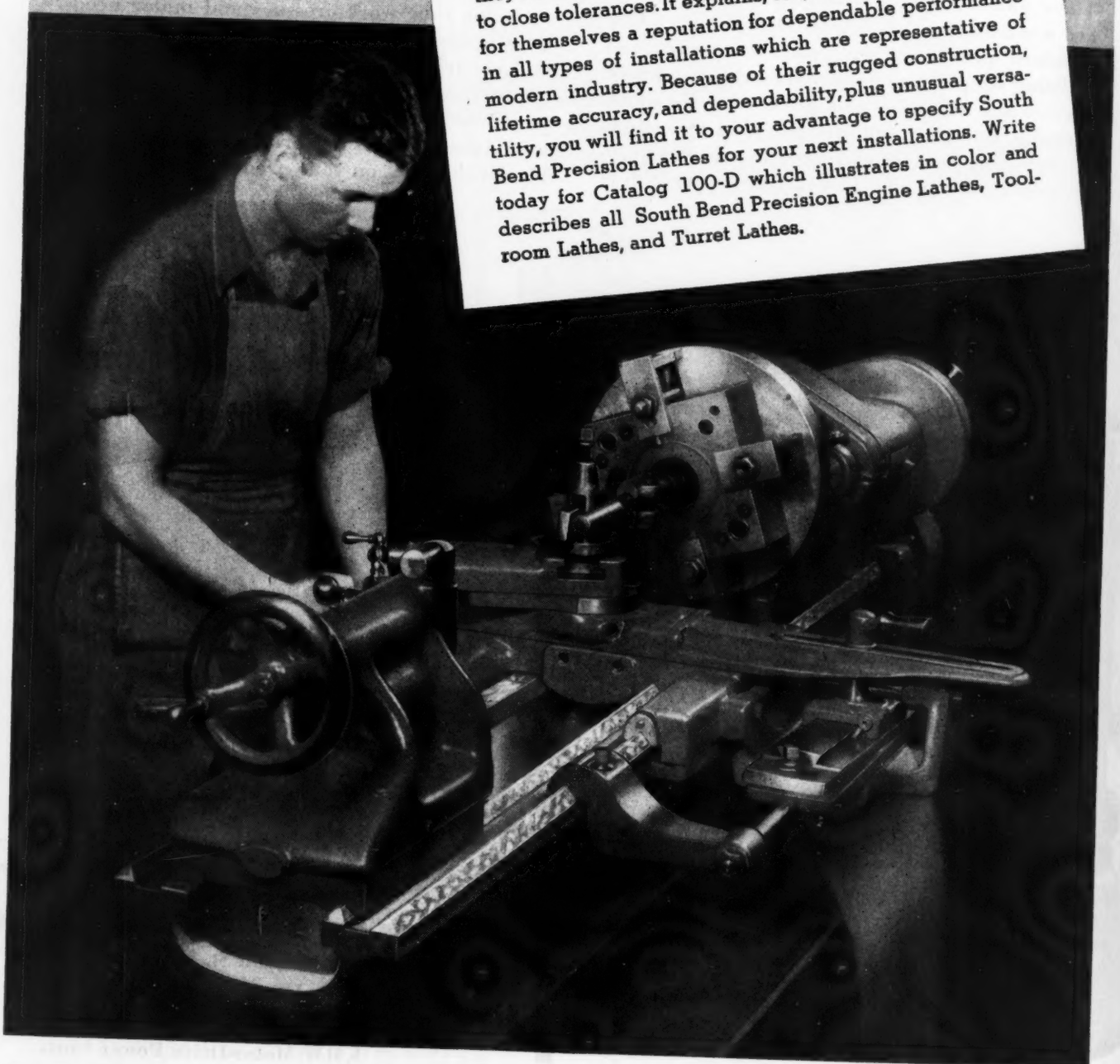
Address.....

City and Zone..... *State*.....

SOUTH BEND
Precision Lathes

RUGGED
ACCURATE
DEPENDABLE

The rugged construction of South Bend Precision Lathes is best demonstrated by the fact that the great majority of all South Bend Lathes ever made still are giving satisfactory service after years of daily use. Their rugged construction explains why, even after many years of service, they continue to produce toolroom and production work to close tolerances. It explains, too, why they have earned for themselves a reputation for dependable performance in all types of installations which are representative of modern industry. Because of their rugged construction, lifetime accuracy, and dependability, plus unusual versatility, you will find it to your advantage to specify South Bend Precision Lathes for your next installations. Write today for Catalog 100-D which illustrates in color and describes all South Bend Precision Engine Lathes, Toolroom Lathes, and Turret Lathes.



SOUTH BEND LATHE WORKS

424 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

LATHE BUILDERS SINCE 1906

SIMONDS gives you the right Band Saw to deliver Top Output and Economy in cutting any type of Metal or Plastic

1. REGULAR HARD EDGE BAND SAWS

Simonds Steel Mills produce a special tough alloy steel for these saws. Teeth are sharp, perfectly milled, and set even on both sides of blade, to give clean, easy cutting and long saw life. And joints are welded for equal strength with rest of blade.

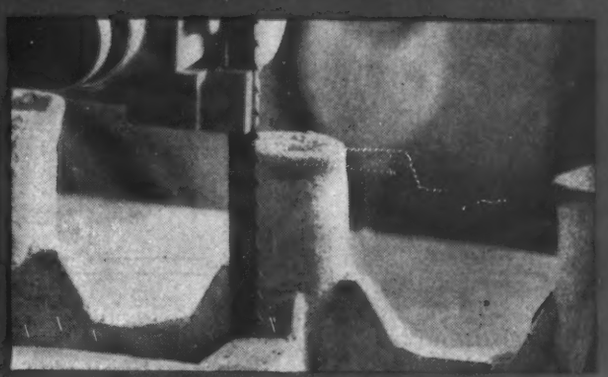
2. SKIP-TOOTH BAND SAWS

Here's the extra gullet-capacity for large chips from aluminum, magnesium, plastics and wood. These saws stay sharp so long that it's economical to replace them and save resharpening. They have the same hardened tooth-edge as the Regular Hard Edge Saws. Made in widths from ½" to 1" Tooth-spacings: 2, 3, 4, and 6 per inch.

3. SPRING TEMPER BAND SAWS

Especially successful in sawing thin sheet aluminum, magnesium, and steel . . . also brass, light structural shapes, plastics, fibre, non-ferrous tubing and similar materials. These blades cut for exceptionally long periods without dulled teeth . . . and then they are quickly reset and filed and put back on the machine.

Consult your Industrial Supply Distributor about the best type and specification of Simonds Band Saw for *your* work. Or write the nearest Simonds office.



SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Other Divisions of SIMONDS SAW AND STEEL CO.

SIMONDS STEEL MILLS	SIMONDS ABRASIVE CO.	SIMONDS CANADA SAW CO. LTD.
Special Electric Furnace Steels	Grinding Wheels and Grains	Simonds Products for Canada

Branch Offices:
1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash.; *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

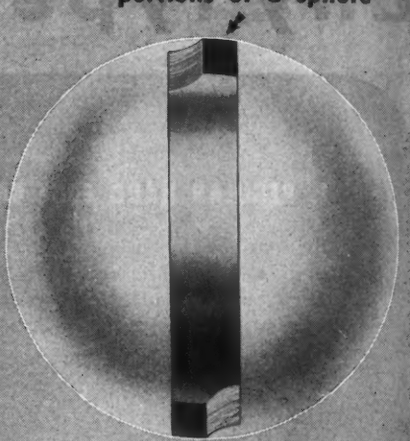
THE BETTER PLUG GAGE

STANDARD

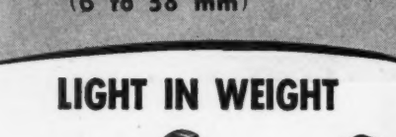
DuBo* Gage

SINGLE END
Sizes 1.510" to 6.010" (38 to 152 mm)

DOUBLE END
Sizes .240" to 1.510" (6 to 38 mm)

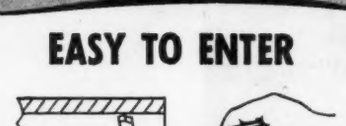


LIGHT IN WEIGHT



DuBo Gages over 1" diameter weigh 70% to 80% less than corresponding AGD cylindrical plug gages. Their lightness gives greater ease in handling, resulting in less strain on the operator, fewer errors due to fatigue.

EASY TO ENTER



DuBo requires no jockeying to enter, even into undersize bores. Inserted with the handle tipped slightly above the bore axis, it enters easily, more easily than even a piloted cylindrical plug gage. This means time saved.

DEFINITE CHECK

The check is made by lowering the handle gently, bringing gaging surfaces in contact with bore walls. Whether or not handle will drop freely below bore axis is the definite, yes-or-no answer even if part is close to limit.

DuBo Gages can detect out-of-roundness and taper whether enlarging toward or away from the opening!

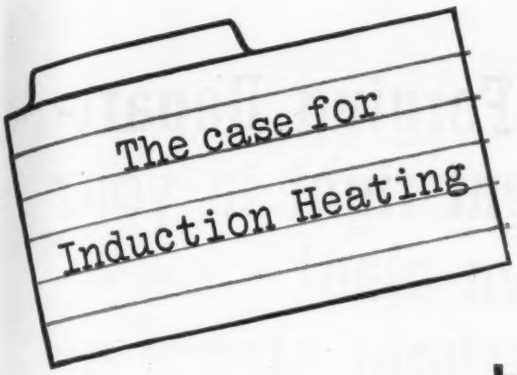
ARMY E NAVY

*Patents Pending

IT ALL ADDS UP TO PRODUCT IMPROVEMENT *along with* COST SAVING

Write for Bulletin

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.



breathing new life into diaphragm assemblies

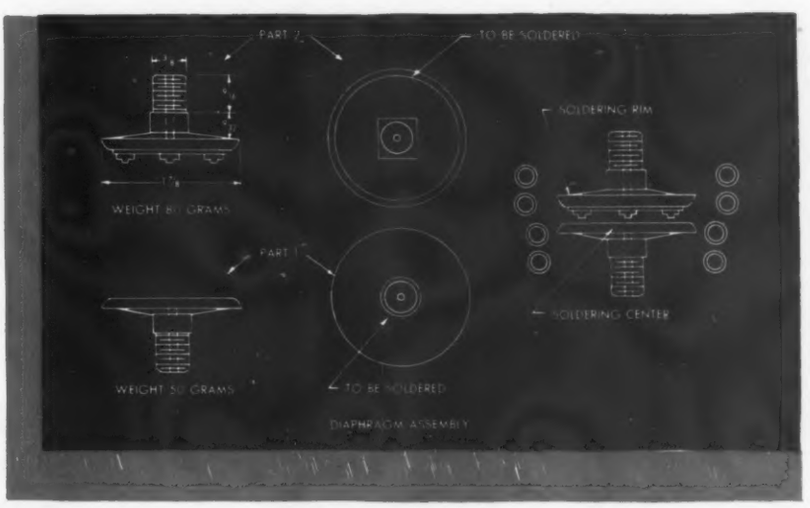
...4 every 10 seconds

If your business involves complicated assemblies, the way induction heating breathed new life into this diaphragm assembly will hold high interest for you.

It's unique in soldering jobs because it brought special problems in soldering around the center of one piece and the rim of the second. The first part soldered around the center must be held so solder won't drip off the edges. Yet the second piece must be positioned so the heat will penetrate to its center, while only reaching the rim of the other.

Experiments led to the final pattern of heating both pieces in a 4-turn, series-connected, inductor coil, the complete fixture consisting of two such units. Equipped with two standard Westinghouse 5-kw r.f. generators, the system works so well it will solder four complete assemblies in 10 seconds!

You gain in all types of modern radio frequency heating, both induction and dielectric, in any phase of heat-treating . . . annealing, brazing, hardening, sintering, curing, bonding, drying and molding.



Write, wire or phone your nearest Westinghouse office today for all the facts. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-08163

HERE'S FREE HELPFUL INFORMATION

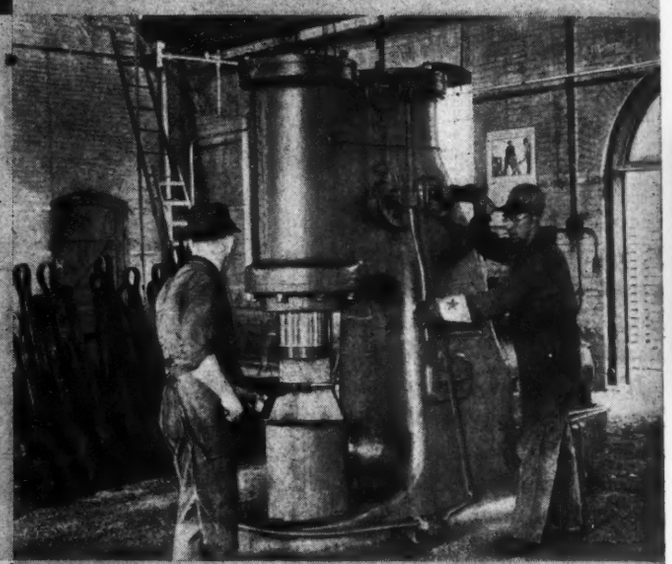
on both induction and dielectric heating . . . their principles and theories; where to use them; how to select them; actual case histories of their use. Write for your copy today, on your business letterhead, please. Ask for B-3620.

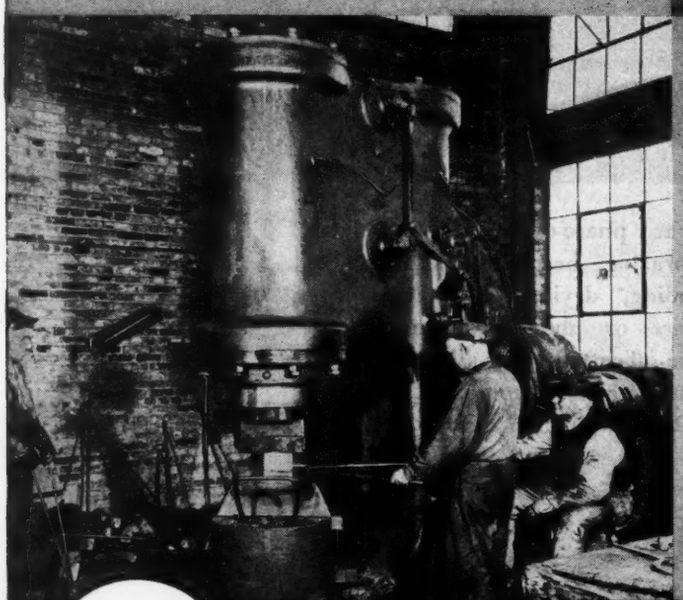
Westinghouse

Electronics at Work

A Forging Department right in your own plant . . . . . without steam or air lines . . . . . .

The Chambersburg Pneumatic Hammer can be located anywhere without respect to steam lines, air lines, shafting or belting. It carries its own source of power — its motor-driven compressor. There is no load on steam boiler or air compressor—yet, wherever electricity is available, it is ready for work instantly.





A wide range of sizes—200 lbs. to 5000 lbs.—makes this unit ideal for practically any forging requirement, from tool room use in forging and dressing tools, in foundry work, as in straightening reinforcing rods, etc., to large forgings for maintenance or production. Write for Bulletin 1275.

CHAMBERSBURG ENGINEERING COMPANY Chambersburg, Pa.

ARMY E NAVY

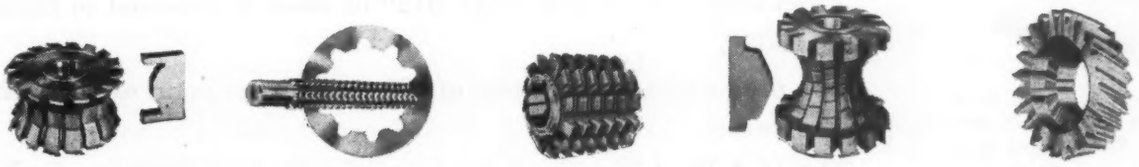
CHAMBERSBURG

HAMMERS · CECOSTAMPS · PRESSES

Reduce Part Costs

WITH ENGINEERED CUTTING TOOLS

Often, Illinois Tool engineers are able to help a manufacturer reduce the production cost of machined metal parts by changing the design of the cutting tools or by recommending a different production technique.



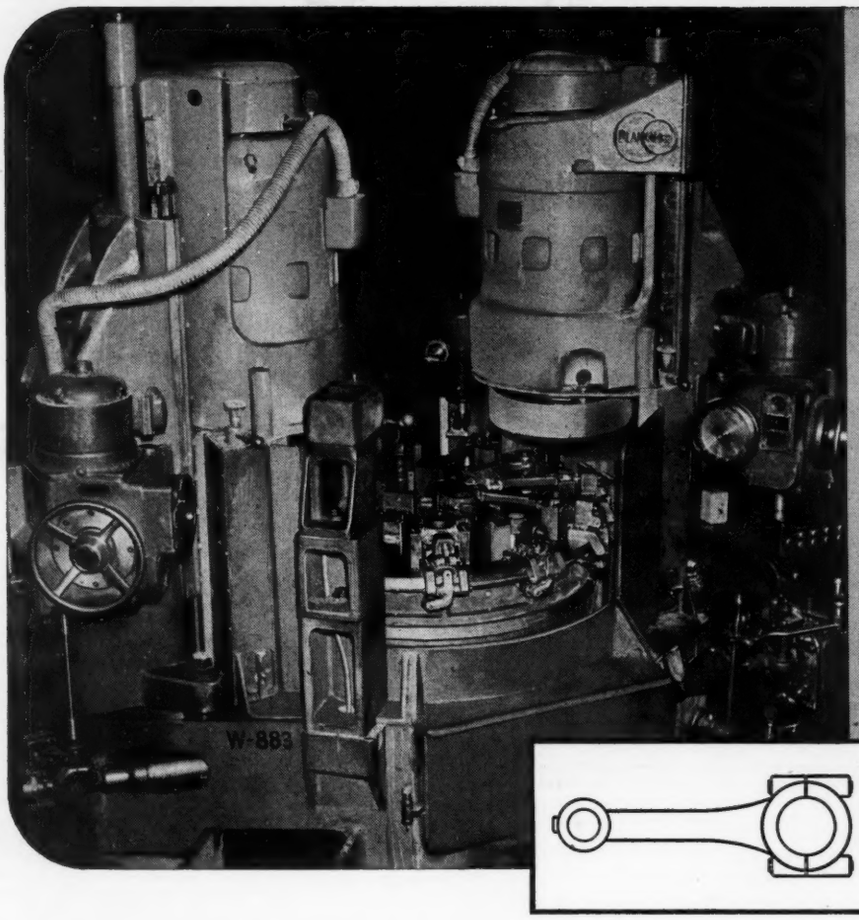
HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

ILLINOIS
TOOL WORKS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

2501 N. Keeler Avenue, Chicago 39, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

"Put it on the Blanchard"



GET THESE *Advantages*

Production ✓
Adaptability ✓
Fixture Saving
Operation Saving ✓
Material Saving
Close Limits ✓
Fine Finish
Flatness ✓

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

These steel forged connecting rods are ground both sides of both ends on a No. 16-A Dual Blanchard Automatic Surface Grinder with a 43" chuck. The special 12-station fixture was designed and built by Blanchard.

From each side of both ends .012" of stock is removed to limits of ± .0005".

The production is at the rate of 400 surfaces per hour, or 100 completed pieces.

The 16-A Dual Blanchard is equipped with two grinding wheels, each with automatic size control, thus insuring the finished dimension.

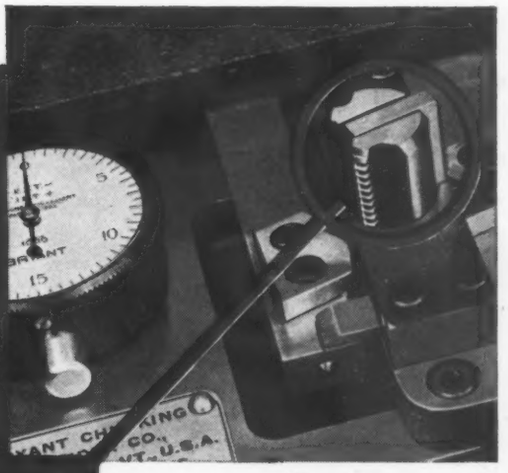
Put it on the Blanchard for more economical production.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

Quality Control made simple ...by the use of BRYANT THREAD GAGES



Internal

External

Quality control — essential to mass production of threaded parts — often slows assembly lines, when time-consuming, conventional gaging methods are used. Yet, inspection can be simple, accurate to any desired tolerance, and extremely fast if you use Bryant Thread Gages. They are easily operated at top speed by anyone. The operator need only squeeze the control lever, drop the part onto the work holder, release the lever. An immediate engagement is made on all the threads. He gives the work a partial turn and the thread is inspected all over. The dial indicator shows the overall accuracy within required tolerances, or accumulated inaccuracies of lead, pitch, diameter and thread form or the presence of burrs. And no "feel for fit" is required and these gages are four-to-five times faster than ring and plug gages.

Do you value quality control in your plant? Then send us part prints covering your problems — our engineers will be glad to advise you. Send the coupon below for Illustrated Catalog G-3.

New Portable Thread Gages, also Squareness of Face Gages, Universal Diameter Size Gages.

Please send me Catalog No. G3 which gives complete details on the Bryant Thread Gages.

Name_____ Title_____

Company_____

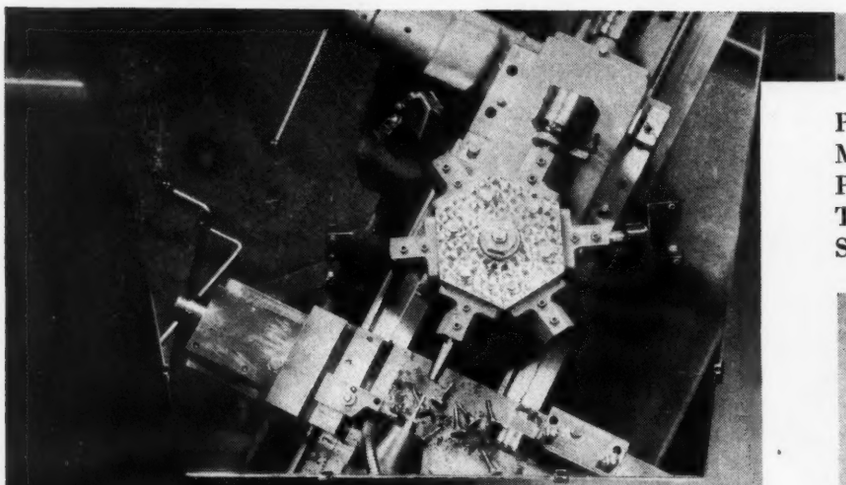
Street_____

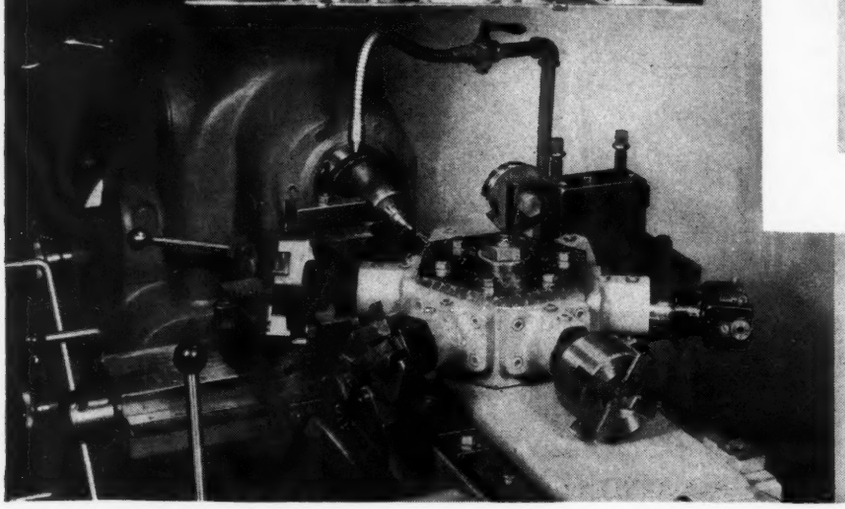
City_____ State_____

BRYANT

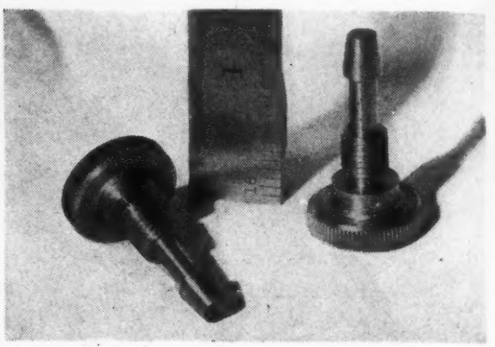
BRYANT CHUCKING GRINDER CO. SPRINGFIELD, VERMONT, U. S. A.

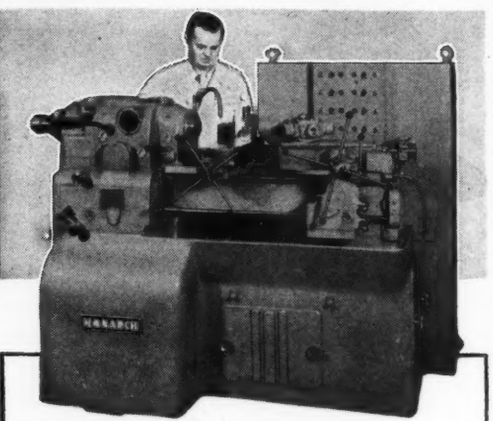
1.38 MINUTES FROM BAR TO FINISHED PART





Part—Stop Screw, Knurled Head
Material—1315 Steel, ¾" Diameter
Preselected Spindle Speeds—6
Time per Piece—1.38 Minutes
Setup Time—54 Minutes





Speedi-Matic Production: 43½ Screws Every Hour! The Monarch Mirror tells the story—18 surfaces machined in six cuts.

Jobs like these are the reasons why users everywhere call the Speedi-Matic "the world's fastest hand screw machine". For toolroom accuracy at production line speed—on lots of 25 to 500 or higher—you can't beat the Speedi-Matic. Get the full facts *now*, while deliveries are still favorable.

THE MONARCH MACHINE TOOL CO.
Sidney, Ohio

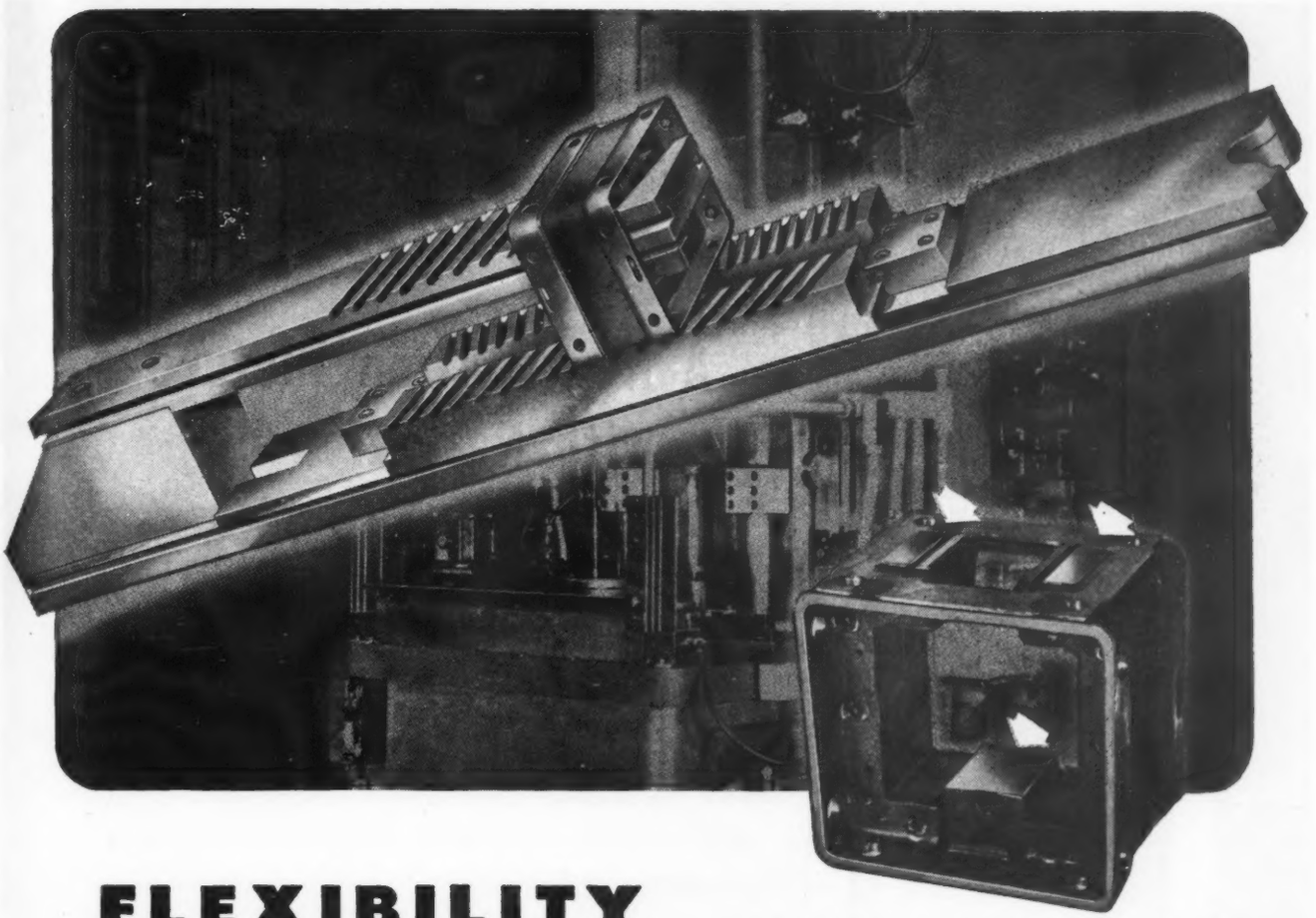
ACCURACY · ECONOMY · LONG LIFE

Monarch
TURNING MACHINES

FOR PEAK PRODUCTION AT A PROFIT SPECIFY SPEEDI-MATIC

Here's what you get:

- **Automatic electronic speed change, preselected for as many as ten stations.,**
- **Complete range of spindle speeds—50 to 5000 rpm.**
- **Feeds from .0005" to .016" per revolution.**
- **Power feed ram-type turret.**
- **Spring-return hand-operated cut-off slide.**
- **Air-fed pusher-type collet attachment.**
- **Collet chuck capacity—⅞".**



FLEXIBILITY

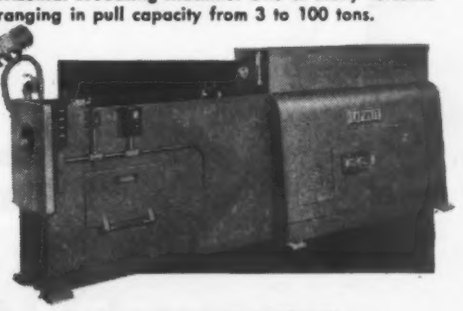
Solenoid frame, whose three indicated surfaces are simultaneously broached to exacting tolerances by Lapointe designed special broach.

Further evidence of the versatile nature of broaching by Lapointe is found in the machining of this General Electric solenoid frame. Flexibility is definitely demonstrated by the distinct difference between this precise operation and the mass production of wrench parts, where six separate machining operations are performed on steel forgings in one cycle of a double ram machine.

The solenoid operation demands exacting specifications requiring the simultaneous broaching of three parallel surfaces — tolerances as close as .0005", and an f3 finish. Furthermore, the stock — laminated silicon iron — must be broached without tearing the laminations. General Electric accomplishes this with one pass of a Lapointe combination push-pull broach, designed so as not to disturb the lamination. Even while meeting these difficult demands, a rate of 100 pieces an hour, including loading and unloading is maintained.

Isn't it possible there is a place for this precision performance in your business? Write The Lapointe Machine Tool Co., for information today.

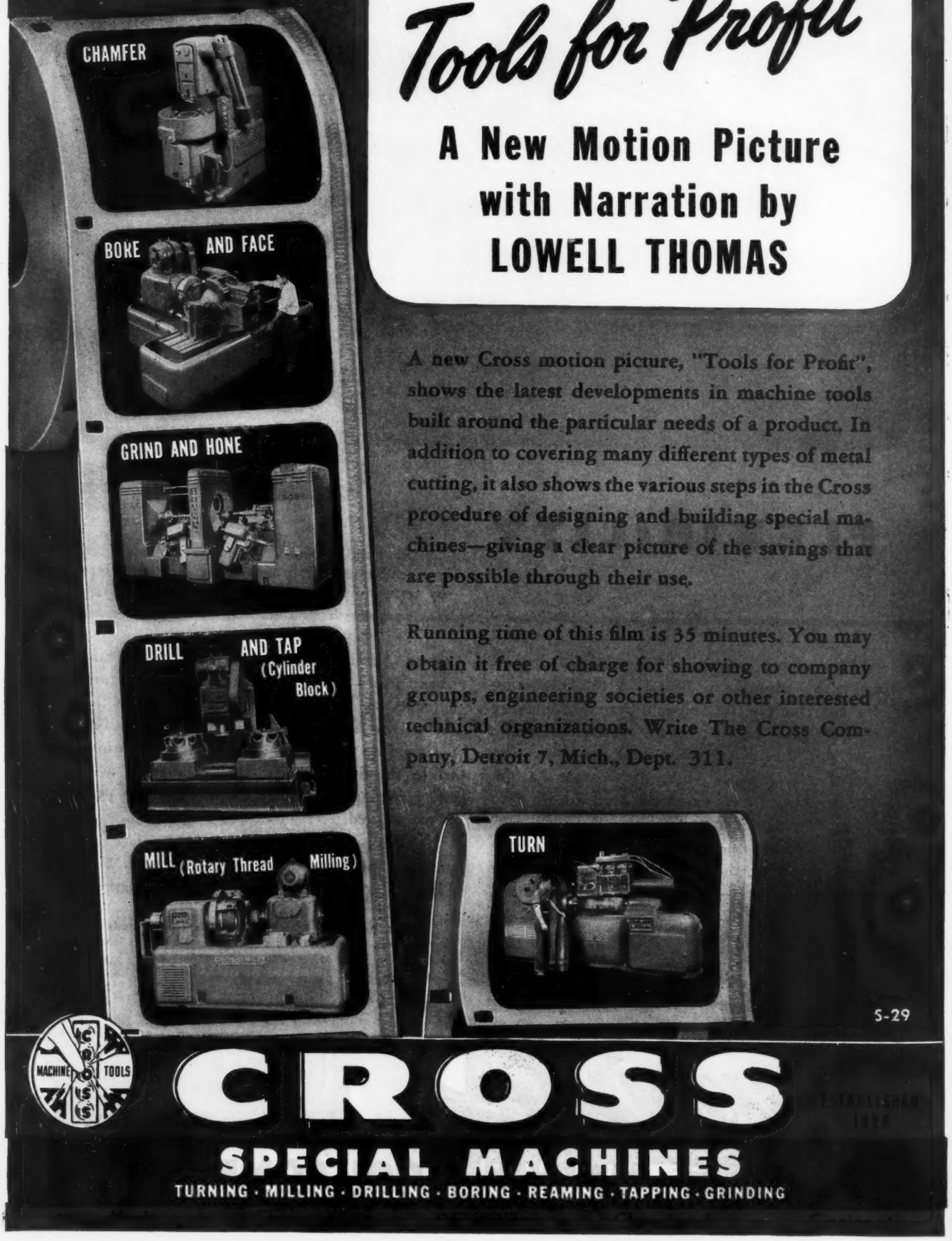
HP-100, Horizontal Broaching Machine. One of many versatile machines, ranging in pull capacity from 3 to 100 tons.

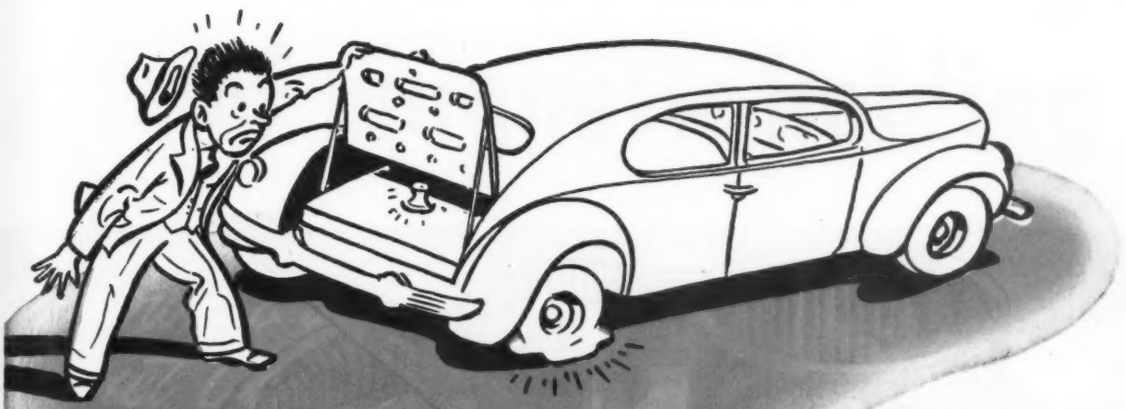


THE Lapointe MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES


CHAMFER
BORE AND FACE
GRIND AND HONE
DRILL AND TAP (Cylinder Block)
MILL (Rotary Thread Milling)
TURN
Tools for Profit
A New Motion Picture with Narration by LOWELL THOMAS
A new Cross motion picture, "Tools for Profit", shows the latest developments in machine tools built around the particular needs of a product. In addition to covering many different types of metal cutting, it also shows the various steps in the Cross procedure of designing and building special machines—giving a clear picture of the savings that are possible through their use.
Running time of this film is 35 minutes. You may obtain it free of charge for showing to company groups, engineering societies or other interested technical organizations. Write The Cross Company, Detroit 7, Mich., Dept. 311.
5-29
CROSS
MACHINE TOOLS
SPECIAL MACHINES
TURNING · MILLING · DRILLING · BORING · REAMING · TAPPING · GRINDING



WOULD YOU DRIVE WITHOUT A *Spare?*

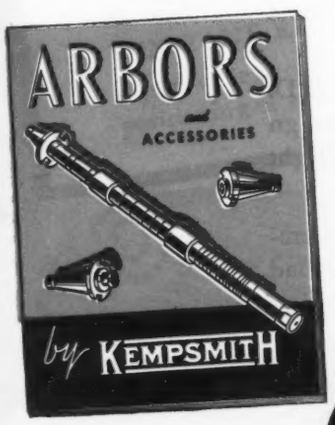
"Just my luck! A flat tire and no spare! What a predicament!"

A machine shop foreman may be in a worse predicament without a spare arbor. When an arbor breaks, production ceases until the arbor is replaced. Machine and manpower hours wasted! Schedules disrupted! Deliveries delayed! That's why we say —

It Pays to Have Several Arbors in Stock

Arbors are "perishable tools" and today their cost is relatively small in comparison to lost hours and disrupted schedules. So play safe! Order your spare arbors today. Remember, Kempsmith Arbors are now available in all popular sizes and types, adaptable to any make of milling machine with standardized spindle.

THE KEMPSMITH MACHINE CO. • 1821 S. 71st Street • Milwaukee 14, Wisconsin



Get Your Copy of this NEW ARBOR BULLETIN

Describes the complete Kempsmith line of Arbors and Accessories. Also gives you helpful information on how to keep your arbors in condition. Fill in and mail coupon — today. No obligation.

Arbors BY KEMPSMITH

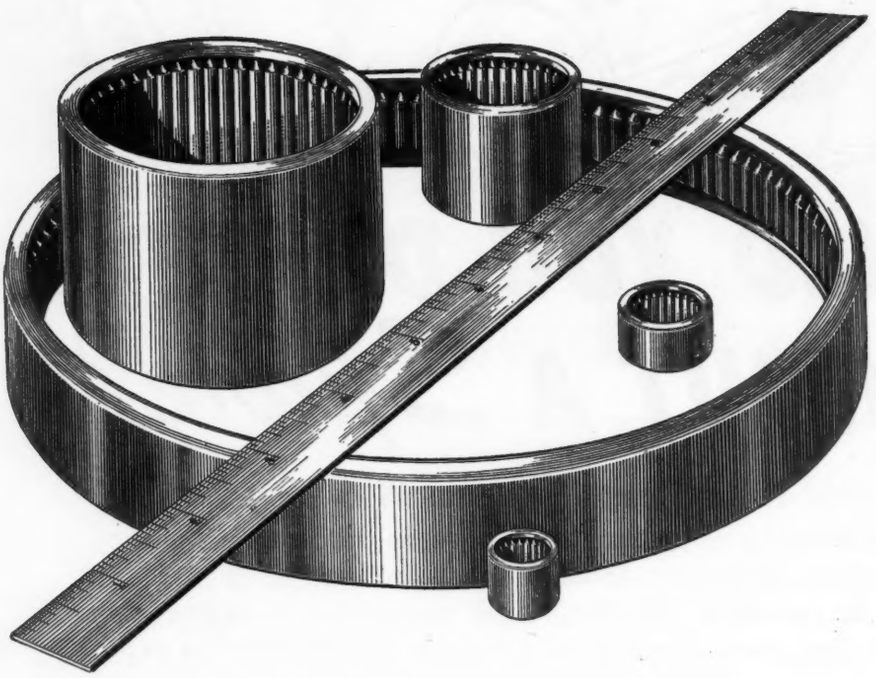
Precision Built Milling Machines Since 1888

Write Today!

KEMPSMITH — Yes, I would like to receive a copy of your new Arbor Bulletin:

NAME..... TITLE.....

FIRM..... ADDRESS.....



How Big Should a Needle Bearing Be?

...Big enough to carry the load. But whatever the actual size required—the Torrington Needle Bearing is the most *compact* anti-friction bearing unit ever devised.

In relation to its radial load capacity it has the smallest O.D. of *any* comparable anti-friction unit—an important design advantage from the standpoint of space-savings and weight reduction.

Experience in hundreds of different applications has demonstrated the practical advantages of this high unit load capacity in terms of design improvement, increased operating efficiency, and manufacturing economy.

Ask our engineering department to translate these Needle Bearing features in terms of *your own design requirements*...to show you how *small* a bearing can be to give you all these advantages. Your inquiry involves no obligation.

THE TORRINGTON COMPANY

TORRINGTON, CONNECTICUT SOUTH BEND 21, INDIANA

Offices in All Principal Cities

TORRINGTON NEEDLE BEARINGS

Get ALL the advantages of magnetic holding

Use Brown & Sharpe Permanent Magnet Chucks

COST NOTHING TO OPERATE .... EVEN TO INSTALL

★No electricity, wires, electrical connections, generators or brushes.

★Nothing to maintain. Special alloy magnets retain energy indefinitely.

SAFE FOR WORKMAN AND WORK

★No danger of work flying off due to power interruption.

★Work can be left on chuck indefinitely without danger of heating either chuck or work.

SIMPLE MECHANICAL CONTROLS

★Hand-operated. Easy 180° movement from ON to OFF position.

★POSITIVE HOLDING

★INSTANT RELEASE

★plus wide variations of holding force for easy positioning of work.

MORE USEFUL IN MORE PLACES

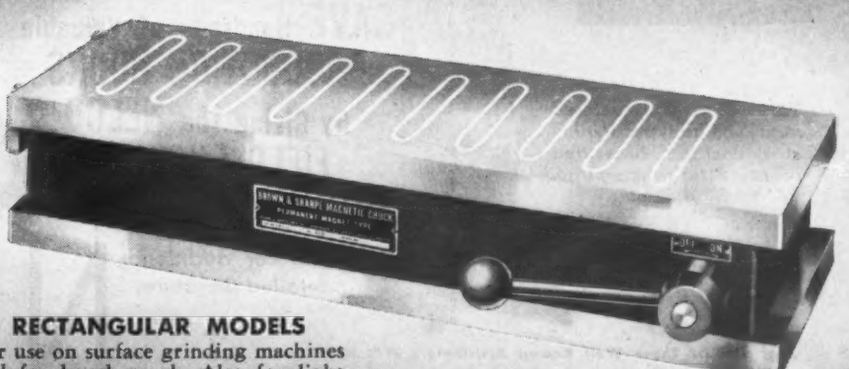
★Portable . . . for use on various machines, also for testing, inspection and laying out work.

★Wet or dry grinding.

★Large, heavy work or groups of small parts.

★These chucks are for sale only in the United States of America and its Territories.

ROTARY MODEL
for grinding operations and light cuts on lathes.



RECTANGULAR MODELS
For use on surface grinding machines and for bench work. Also for light cuts on planers, shapers and milling machines.

ALSO permanent magnet V blocks and dial test indicators with magnetic bases.

WRITE FOR CATALOG describing operating principles.

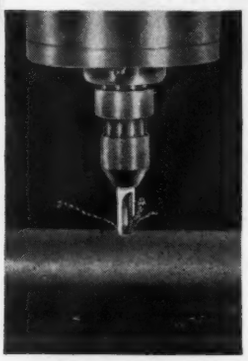
BROWN & SHARPE MFG. CO., Providence 1, R. I.

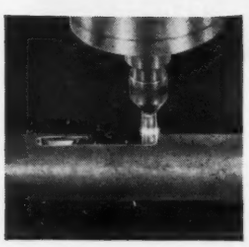
BROWN & SHARPE

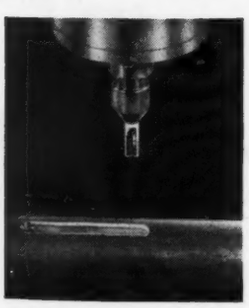
NELCO *Carboloy-Tipped* 3 FLUTE END MILL

did this job *in 1/6th the Time*

New NELCO 3 FLUTE CARBOLOY-TIPPED END MILL:







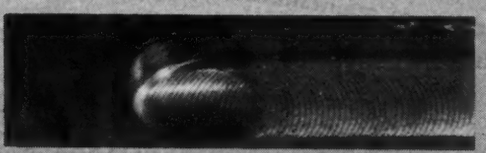
- Plunges into solid metal and mills. Will bore hole and mill in one operation.
- Eliminates Chatter—providing smoother cutting—a better job in astonishingly reduced time.
- Mills so smoothly that a finished cut is either not required at all, or to a much lesser degree.
- Stays sharp much longer—doesn't require resharpening as often.
- Provides Cooler and Freer Milling—More CHIP room decreases the chance of work overheating and twisting.

and did it *Better!*

One of the objective tests used by Nelco Engineers was the cutting of a "keyway". (Results illustrated below) End Mills compared were high-speed steel and Nelco's new Carboloy-tipped 3 FLUTE. Material was S.A.E. 1095 steel shafting. End Mills were ½" diameter; a 3 H.P. milling machine was used in both cases; 2400 R.P.M. and 14" per minute feed was used for the Carboloy; 609 R.P.M. and 3" per minute feed for the high-speed steel.

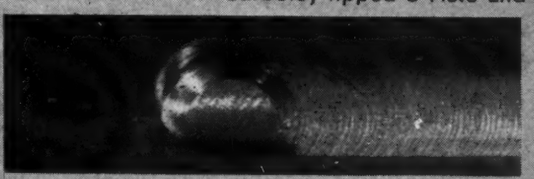
OPERATIONAL RESULTS:

2 MINUTES—To complete the job using high-speed steel end mill.



NOW COMPARE NELCO RESULT!

20 SECONDS—Job completed using Nelco's new Carboloy-tipped 3 Flute End Mill!



NOTE: ABOVE TEST PHOTOS UNRETOUCHED

This tool is manufactured for use on all types of alloy steel, cast iron, brass and bronze. Sizes ranging from ⅜" to 2" diameter.

SAVE Hundreds of Valuable PRODUCTION HOURS By Giving The NELCO FIELD ENGINEER A Few Minutes Time!

Write for additional detailed literature.

For more complete details of this and other tests conducted by Nelco, write or see your local Nelco Field Engineer.

NELCO also manufactures a complete line of Carboloy-Tipped Milling Cutters, End Mills, and Twist Drills.

Any One Of These Well Known Distributors Will Be Glad To Help You

Albany—Sager-Spuck Supply Co., Inc.
Baltimore—L. A. Benson Co., Inc.
Bridgeport—Hawley Hardware Co.
Brooklyn—A. N. Nelson, Inc.
Cambridge—Robert E. Morris Co.
Cleveland—J. W. Mull, Jr.
Detroit—B-H Tool and Supply Co.
Indianapolis—J. W. Mull, Jr.
Newark—A. N. Nelson, Inc. Div. General Carbides Co.
Philadelphia—Carey-McFall Co.
Pittsburgh—J. W. Mull, Jr.
Syracuse—A. V. Wiggins & Co.
Toledo—J. W. Mull, Jr.
Waterbury—White Supply Co.
West Hartford—Robert E. Morris Co.
York—L. A. Benson Co., Inc.

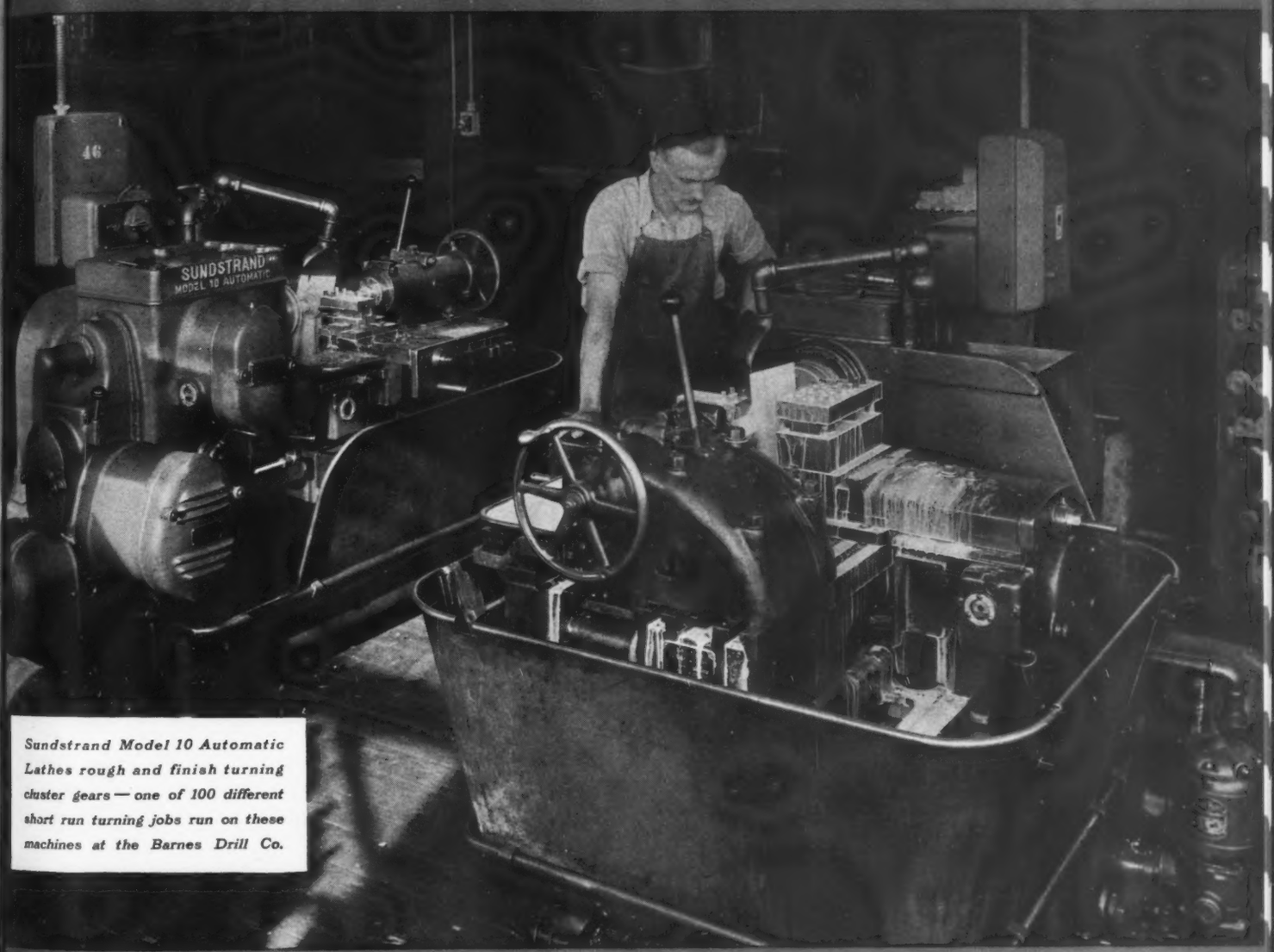
NELCO TOOL CO., INC.

For That *EXTRA EDGE* In Production

370 Hamilton Avenue, Dept. MC, Brooklyn 31, N. Y.

ROCKFORD Metalworking Production Ideas

August, 1946



Sundstrand Model 10 Automatic Lathes rough and finish turning cluster gears — one of 100 different short run turning jobs run on these machines at the Barnes Drill Co.

AMERICAN BROACH & MACHINE CO. ★ ANDERSON BROS. MFG. CO. ★ BARBER-COLMAN COMPANY
Div. of Sundstrand Machine Tool Company

BARNES DRILL CO. ★ JOHN S. BARNES CORP. ★ W. F. & JOHN BARNES CO.

GREENLEE BROS. & CO. ★ MATTISON MACHINE WORKS ★ REHNBERG-JACOBSON MFG. CO.

ROCKFORD CLUTCH DIVISION ★ ROCKFORD MACHINE TOOL CO. ★ SUNDSTRAND MACHINE TOOL CO.
Borg-Warner Corporation

CYLINDER BORES *Mirror Finished* WITHIN .0005"

For honing one bore at a time in cylinder blocks, the BARNESDRILL No. 307 Single Spindle Hydraulically Reciprocated Honing Machine is arranged with six quick change geared speeds, 25" spindle travel, hydraulically controlled hone expansion, and special hydraulic operated lateral indexing table. A BARNESDRILL No. 2 Magnetic-Automatic Coolant Separator is included to assure better quality of smooth, bright finish of cylinder bores.

BARNESDRILL No. 320 Special Duplex Type Angular Hydraulic Honing Machine for honing cylinder bores of V-8 motor blocks. This machine has two 4-spindle, fixed center, auxiliary heads, with hydraulically operated fixture including transfer mechanism, locating pins, and hydraulic clamping. A BARNESDRILL No. 4 Magnetic-Automatic Coolant Separator is an important part of the machine. All magnetic swarf and entrained abrasive particles are magnetically attracted and automatically removed from the coolant by the Separator.

This BARNESDRILL No. 320 Multiple Cylinder Hydraulic Honing Machine has an 8-spindle auxiliary head for both rough and finish honing operations on vertical cylinder blocks. Heads are interchangeable for handling 4, 6, or 8 cylinder blocks. A BARNESDRILL No. 4 Magnetic-Automatic Coolant Separator is part of this honing machine for removing all metal swarf and other impurities from coolant.

BARNESDRILL No. 320 MULTIPLE CYLINDER HYDRAULIC HONING MACHINE PRODUCES GREATER ACCURACY AND FINER FINISH... PERMITS CLOSER TOLERANCES

The extreme accuracy and surface finish generated by the *honing process* in cylinder bores of automobile engine blocks enable this manufacturer to increase car performance and operating efficiency. The new BARNESDRILL No. 320 Special Duplex Type Angular Hydraulic Honing Machine proves the *quickest, lowest cost* method for honing V-8 cylinder blocks.

Honing removes required amounts of stock from all cylinders; eliminates high spots in the bore; generates size; generates accuracy for roundness and straightness; and produces any desired degree of surface smoothness. Final dimensional size accuracy within .0005" to .001" and surface finish of 2 to 3 micro-inches in hardest materials is easily obtained and consistently maintained.

Honing Can Be Profitably Adapted to Your Work

Whatever your product... where extreme accuracy and mirror smooth finish of internal and external surfaces are essential... there is a BARNESDRILL Honing Machine, with one or more spindles to accomplish *finer finish, greater accuracy, improve your product, with production increased and costs reduced.* BARNESDRILL Honing Machines are available in vertical, horizontal or angular types; and will handle work up to and more than 40" diameter and lengths up to 75 feet or longer.

BARNESDRILL engineers will help you select the proper honing machine for your specific requirements. Send your blueprints of parts for analysis and suggestions. There is no obligation.

RIGHT NOW... Send for Bulletin No. 152-M describing the new BARNESDRILL No. 320 Multiple Cylinder Hydraulic Honing Machine and Bulletin No. 148-M which describes the BARNESDRILL Single Spindle No. 307 Honer. Both sent on request, without cost.

Barnes Drill Co. 814 CHESTNUT STREET ROCKFORD ILLINOIS, U.S.A.

MADE IN **ROCKFORD**... TESTED ENGINEERING AND CRAFTSMANSHIP ILLINOIS, U.S.A.

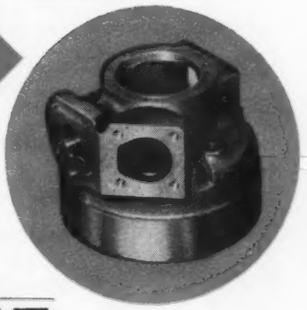
GREENLEE

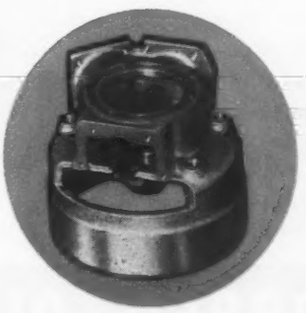
24-STATION TRANSFER MACHINE DOES 31 DIFFERENT OPERATIONS, DELIVERS 188 PIECES PER HOUR

The majority of all the many machining operations required on cast-iron Compressor Bodies for a leading line of domestic refrigerators are performed on this 100-foot-long machine. All of the 31 operating units are fully automatic, hydraulically operated, and electrically interlocked. Each station is a twin unit, working on two pieces simultaneously. The machine produces 188 pieces per hour at 80% efficiency. *This is an excellent example of the trend in production-machinery design, to meet the demands for efficiency, speed, and low machining cost where large quantities of identical pieces are required.*

There are 152 separate operations performed on each pair of Compressor Bodies as they go through 19 working stations, 2 inspection stations, 1 loading station, and 2 idle stations. These operations require 50 drills, 12 face mills, 2 side mills, 2 end mills, 12 boring tools, 38 chamfering tools, and 36 taps. There are 39 motors on the machine, totaling 169 horsepower. Eight miles of wire connects 148 limit switches, 78 indicating lights, 107 push buttons, and 226 magnetic starters, contactors, and timers. Not shown in the picture are a power driven return conveyor for the work-holding fixtures, and a power driven chip conveyor running underneath the full length of the machine.

Left, the rough casting with preliminary machining. The skirt is finished, the main center bearing roughed, and two locating dowel holes drilled in the skirt.





Left, two views of the piece as it comes off the GREENLEE Machine, showing the variety of work performed from 3 side directions and above. Only two operations — diamond boring the cylinder and main bearing, and grinding or lapping the cylinder head contact face — remain before the piece is completed and ready for assembly.

GREENLEE BROS. & CO.

1868 MASON AVENUE, ROCKFORD, ILLINOIS

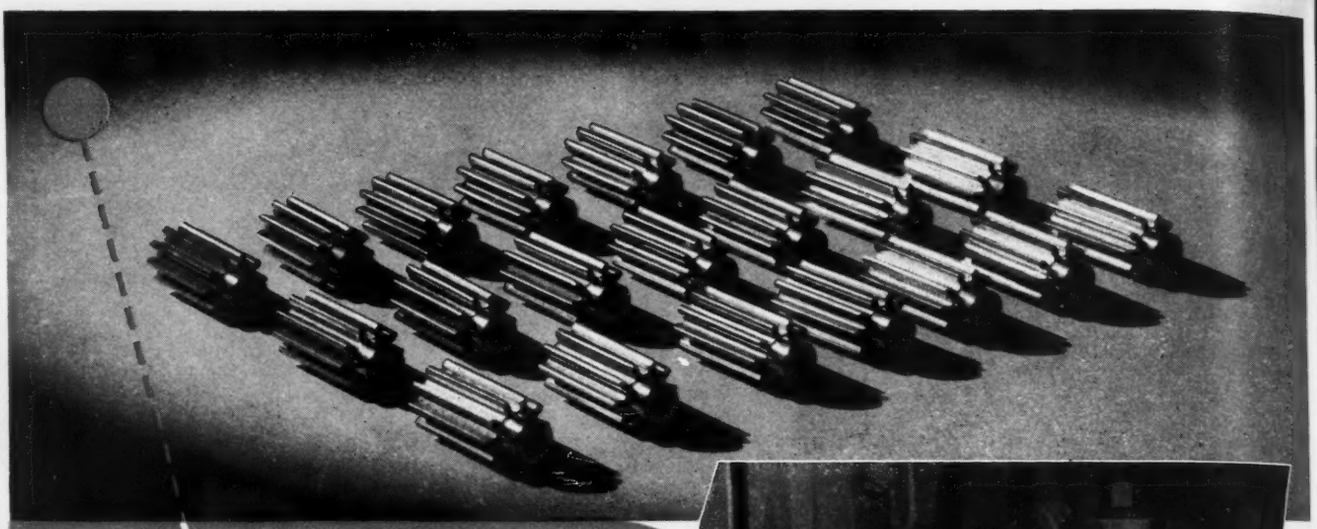
PRODUCTION MACHINERY

GREENLEE

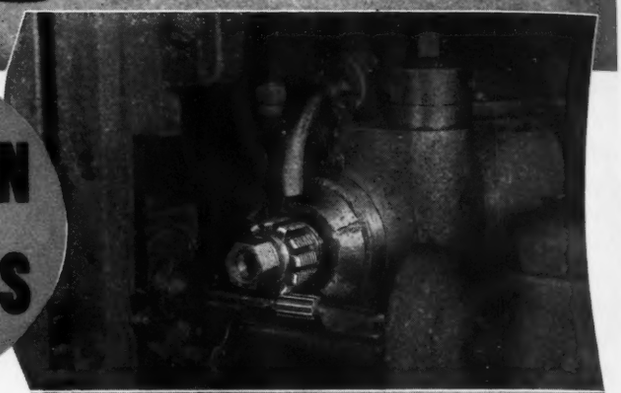
MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

MADE IN

FOR RIGID ACCURACY IN MACHINE TOOLS... ROCKFORD ILLINOIS, U.S.A.



A PRECISION PINION every 15 SECONDS

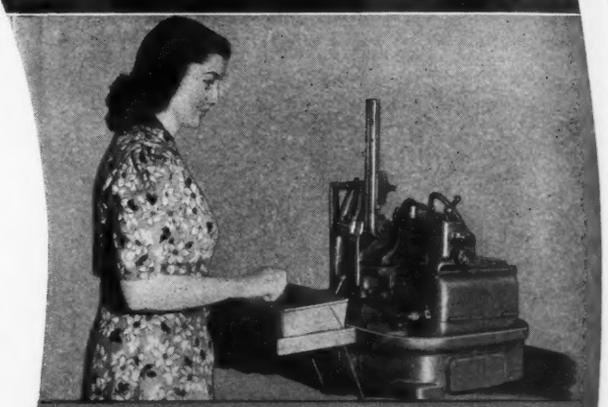


B-C TYPE S AUTOMATIC HOBBING MACHINE PRODUCES ACCURATE FINE PITCH WORK . . . AT HIGH PRODUCTION

A prominent clock manufacturer uses 13 Barber-Colman Type S Automatic Hobbing Machines to produce well over 290,000 precision 10-tooth, 48 pitch involute pinions every week. The pinions have a .440″ face, and they are machined from brass rod. This battery of Barber-Colman Hobbing Machines has been operated 16 hours a day, 6 day week, and each machine has turned out approximately *240* PRECISION PINIONS per hour. These pinions must meet the exacting requirements of this manufacturer. They are extremely accurate and have the extra fine finish so essential to SMOOTH gearing. The B-C hobs used on this job produced *2160* PIECES PER SHARPENING, in three settings.

FOR *LOW COST* PRODUCTION . . . OF PRECISION SMALL GEARS AND PINIONS

Where manufacturers of small precision instruments require fine pitch spur gears and pinions, up to 1″ diameter by ½″ face, in unusually large quantities . . . with ACCURACY and FINISH . . . the B-C Type S Automatic Hobbing Machine is the most economical, low cost, PRODUCTION method available today. Ask your nearest B-C Hobbing Engineer to show you the many distinct advantages of this unusually fine machine . . . with no obligation, of course.



JOB FACTS — Name of Part — Pinion
Material — Brass Rod
Operation — Hobbing 10-tooth, 48 pitch involute pinions, outside diameter .249″–.002″; face width .440″–.010″; pitch diameter .2081″
Hobbing Machine — Barber-Colman Type S Automatic Hobbing Machine
Hob — B-C Unground Hob
Feed — .015″ per rev. of work
Speed — 2041 R.P.M.
Production — Approximately 240 pieces per hour per machine; 13 machines produce 290,000 pieces per week.
Hob Life — 2160 pieces per sharpening.
Hob Settings — Three

Write Barber-Colman for Bulletin F-1474-2, giving a complete description and other data of the Type S Automatic Hobbing Machine; sent *free* upon request on company letterhead.

HOBBING MACHINES, HOBS, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

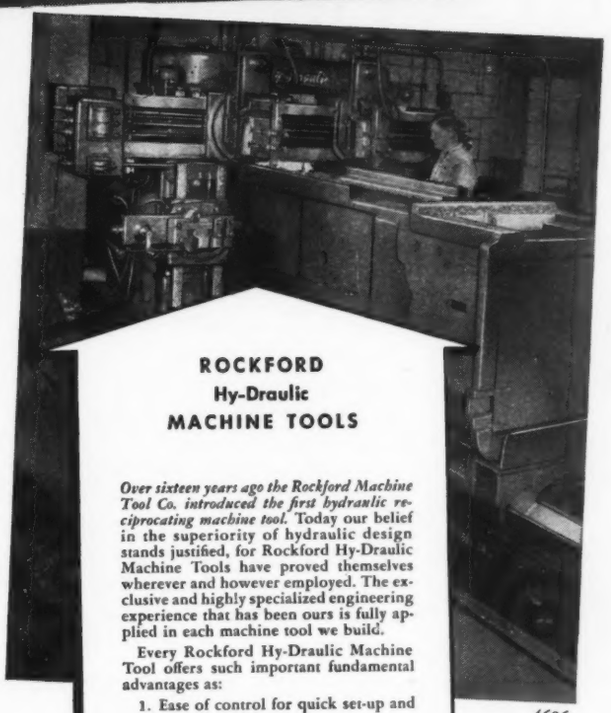
GENERAL OFFICES AND PLANT • 109 LOOMIS ST. • ROCKFORD, ILL., U.S.A.

BARBER B-C COLMAN

MADE IN **ROCKFORD**... FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U. S. A.

Hy-Draulic



4606

ROCKFORD
Hy-Draulic
MACHINE TOOLS

Over sixteen years ago the Rockford Machine Tool Co. introduced the first hydraulic reciprocating machine tool. Today our belief in the superiority of hydraulic design stands justified, for Rockford Hy-Draulic Machine Tools have proved themselves wherever and however employed. The exclusive and highly specialized engineering experience that has been ours is fully applied in each machine tool we build.

Every Rockford Hy-Draulic Machine Tool offers such important fundamental advantages as:

1. Ease of control for quick set-up and fast operation.
2. Stepless Speeds . . . infinitely adjustable throughout a wide specified range. Hy-Draulic tool-head feeds similarly adjustable.
3. Efficient, smooth hydraulic pressure . . . maintains cutting speed as set, no matter how work resistances may vary.
4. Smooth, fast reversals and high return-stroke ratios. Oil flow through Hy-Draulic System is instantly reversible. Simplicity of Hy-Draulic System holds inertia factors to a minimum.
5. Fine finish and long tool life. Smoothness of Hy-Draulic drive, free of mechanical play and vibration, protects work and cutter.

Rockford Hy-Draulic Machine Tools assure quality work with speed at minimum cost. Let the Rockford sales engineer give you complete information.

low bridge

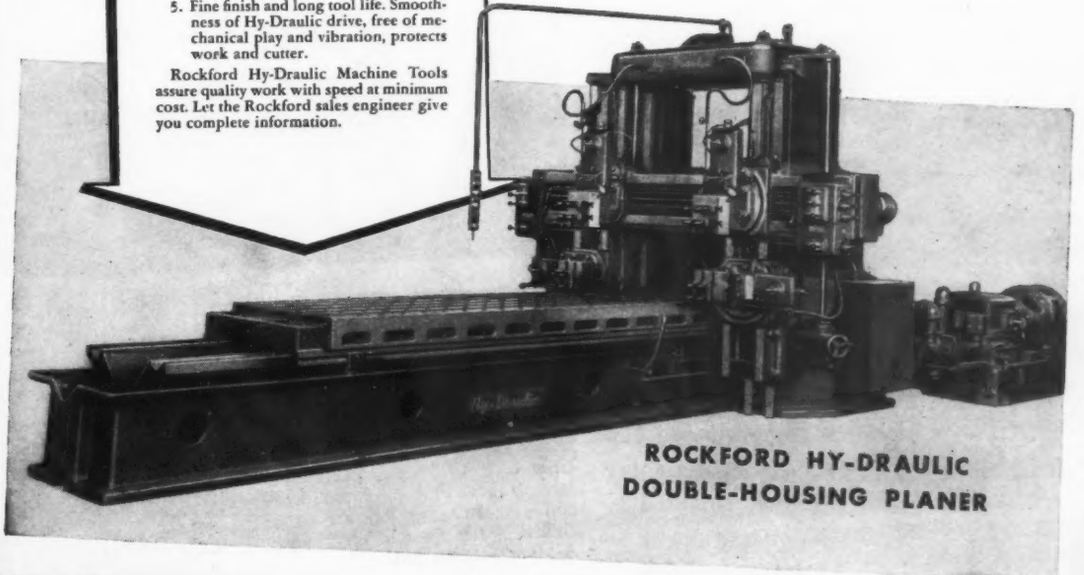
With the cross rail snuggling the top brace, this Rockford 48″x48″ Hy-Draulic Double-Housing Planer is handling a 46″ high, five ton casting with speed, ease and accuracy. On the particular job shown, set-ups require stroke lengths of as little as 8″, with the tool heads feeding across the entire width of the casting. Hy-Draulic drive can take work like that in stride without sacrifice of speed in either cutting stroke or reversal. Rigidity of Rockford Planer construction is also demonstrated here; work is smooth and accurate although the cross rail is raised to near-top position.

Rockford Hy-Draulic Double-Housing Planers are built in four standard sizes, from 36″x36″ to 60″x60″, each size is available in six maximum stroke-length ratings ranging from 10 feet to 20 feet. You are invited to write for complete information on these machines. Ask for Bulletin 1536

ROCKFORD MACHINE TOOL CO.
ROCKFORD, ILLINOIS

Hy-Draulic

SHAPERS·PLANERS·SLOTTERS·SHAPER-PLANERS



ROCKFORD HY-DRAULIC DOUBLE-HOUSING PLANER

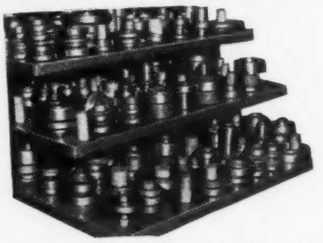
MADE IN
CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD
ILLINOIS, U.S.A.

HERE'S YOUR ANSWER TO INCREASED PRODUCTION AND LOWER TURNING COSTS...

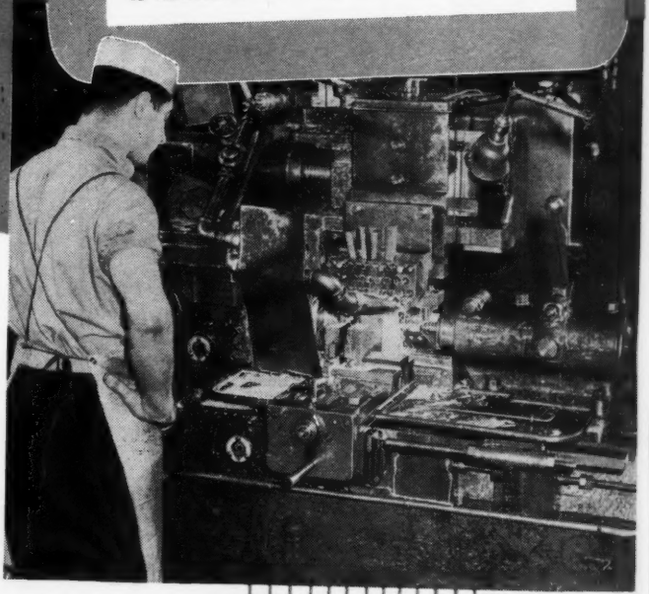
Multiple Tooling *plus* Automatic Cycling

with a SUNDSTRAND AUTOMATIC LATHE

1 SHORT RUN TURNING



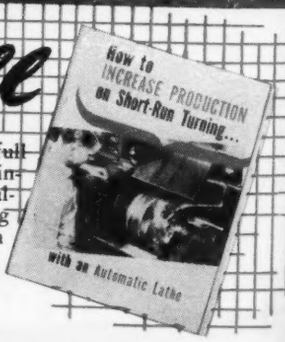
Over 250 gear blanks of different sizes and shapes are multiple-tool-turned on this Sundstrand automatic lathe. Prorated set up time and turning time per piece total 40% less than the machining time required for the previous method. Use of three tool slides made it possible to distribute the cuts more evenly and use heavier tool bits to utilize maximum cutting speeds and feeds. In this way a superior finish is produced, maximum production is obtained and tool life increased.



● Whether your turning problem is a mass production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle change-over. They will also assist in designing the most profitable processing method for the job at hand.

All of the advantages of multiple tool turning are available for both short run and mass production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes. Described here are three typical cases in which Sundstrand "Engineered" production assisted plant engineers in designing a tooling method which resulted in lower turning costs.

MORE TURNING FACTS *Free*

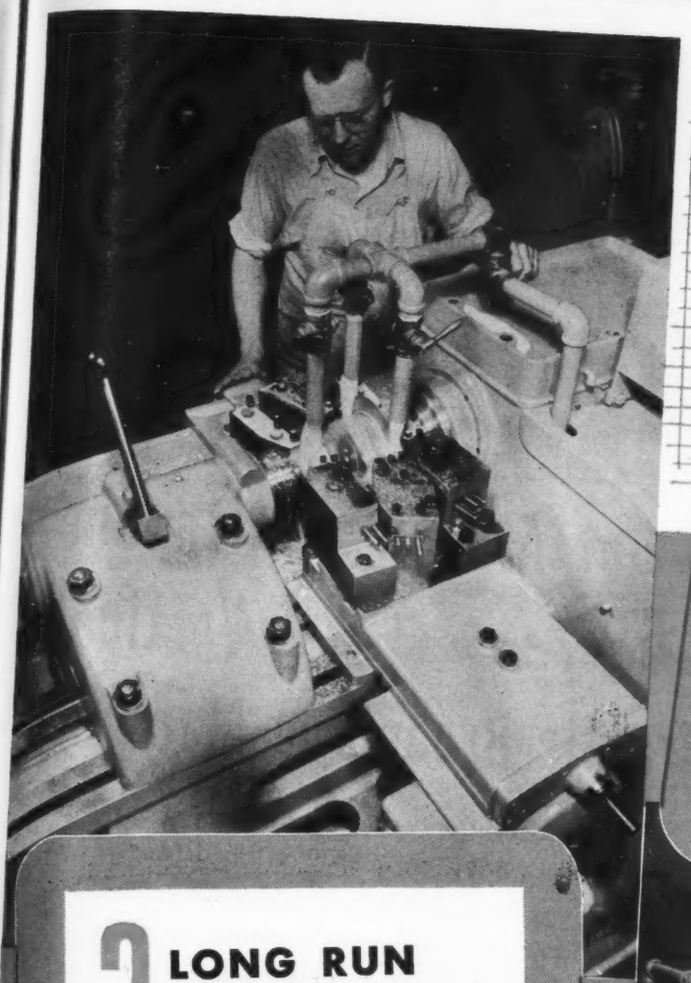


This 44 page booklet, crammed full of technical data and production information shows how to apply multiple tooling to countless turning jobs. Short-run, mass production and special turning jobs are all included. Write for your copy today. Ask for bulletin 651.

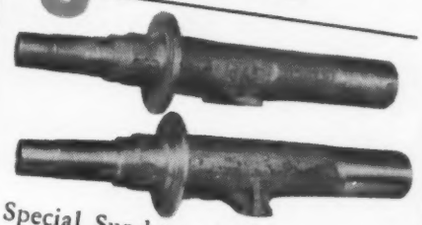
SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

RIGIDMILS | FLUID-SCREW RIGIDMILS | AUTOMATIC LATHES | HYDRAULIC EQUIPMENT

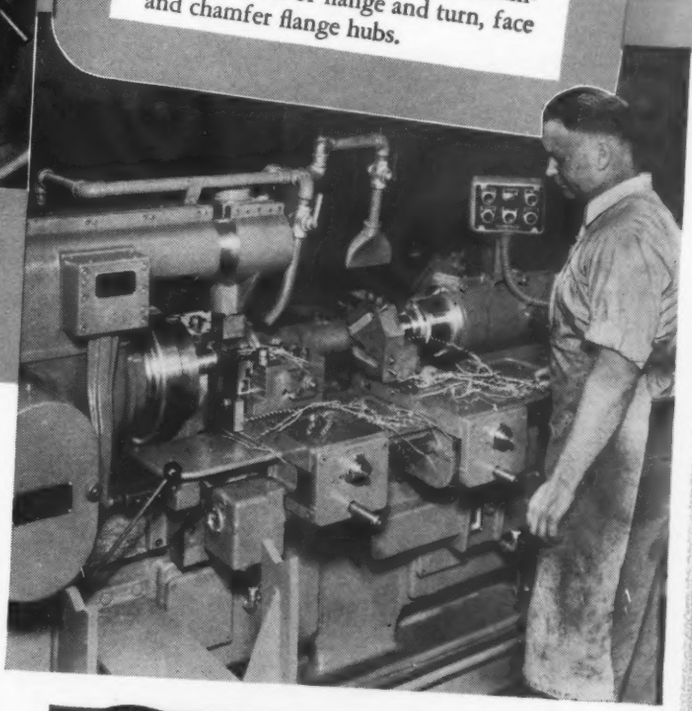
MADE IN **ROCKFORD**...FOR ACCURATE, FAST METAL REMOVAL
ILLINOIS, U.S.A.



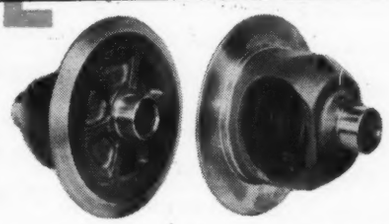
3 SPECIAL TURNING



Special Sundstrand lathe equipped with two longitudinal feeding front carriages, two cross feeding rear tool slides and one special longitudinal feeding overhead tool slide. Thirteen T. C. tipped tools: rough and finish turn and form tube end, turn O. D. and rough and finish face and chamfer both sides of flange and turn, face and chamfer flange hubs.



2 LONG RUN TURNING



Here's automatic cycling for continued accurate reproduction of parts, ample power and rigidity for carbide tools, 250" per minute rapid traverse and simple, effective tooling for turning twelve surfaces in one cycle. This Sundstrand automatic lathe is equipped with two left-hand feeding front tool slides, one right-hand feeding front tool slide and one cross feeding rear slide to finish turn, face and chamfer a differential case. Twelve T. C. tipped tools complete the operation in one cycle.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

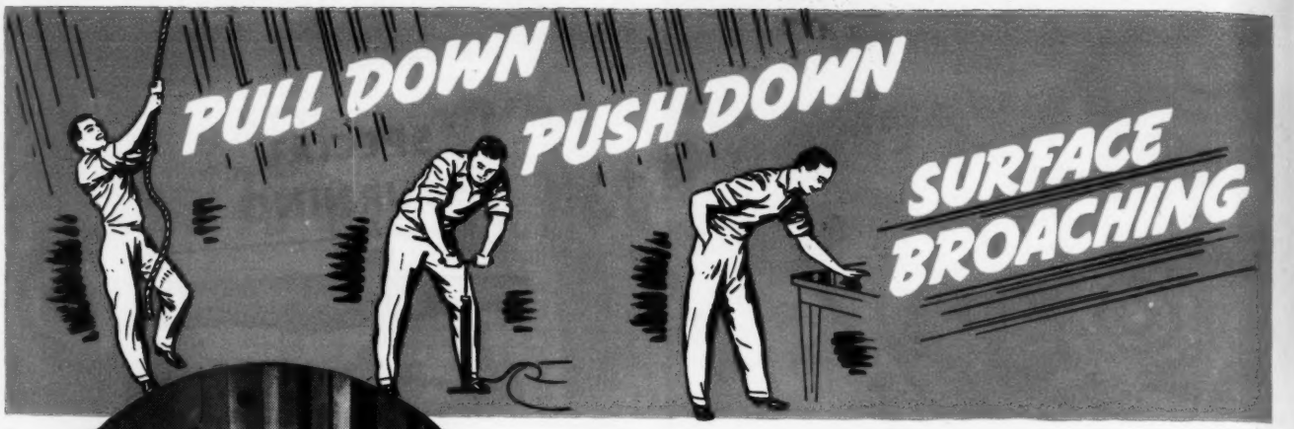
SUNDSTRAND MACHINE TOOL COMPANY

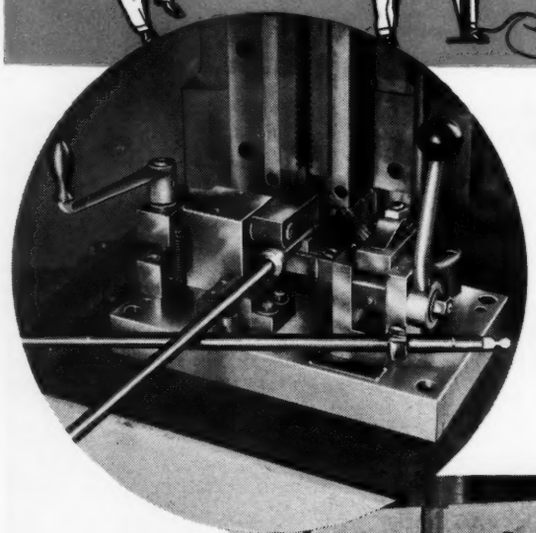
2530 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES | **SPECIAL MILLING AND TURNING MACHINES**

MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD ILLINOIS, U.S.A.





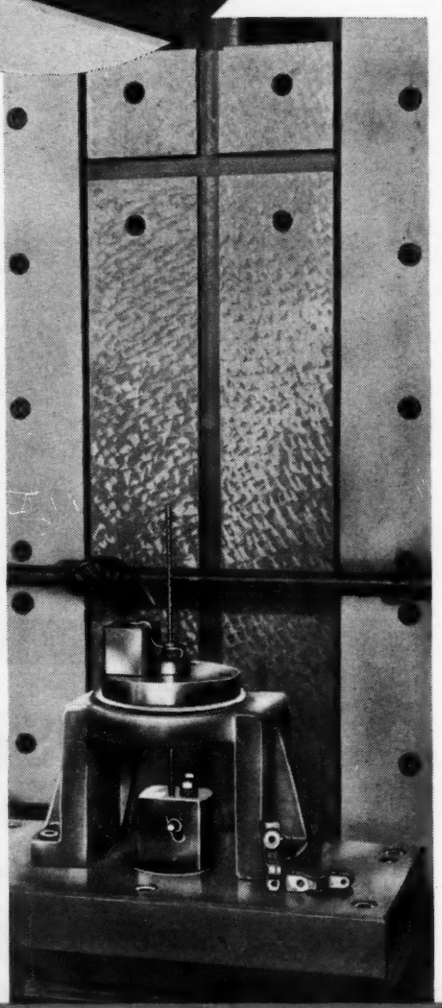
You Get All Three with One *American* 3-Way Vertical Hydraulic Broaching Machine

Changeover from one type of broaching operation to another is done quickly on standard *American* 3-Way Vertical Hydraulic Broaching Machines. Compact, and of durable construction, these machines are designed to perform internal and surface broaching operations with extreme accuracy at a high rate of production. They are available with 24″ stroke in 4, 6, and 8-ton capacities, and with 36″ stroke in 6, 10, and 15-ton capacities.

Whatever your production problem, you can profitably make use of *American's* complete broaching service—machines, tools, and engineering. There is no obligation. Write, wire, or phone *American* today.

ABOVE: Standard *American* T-10-36 3-Way Broaching Machine arranged for surface broaching automotive transmission gear shift lever. The tang of one part is straddle-broached at left hand station while the keyway of another part is being cut at right hand station.

RIGHT: Broaching serrations in a lever part with standard *American* T-6-24 3-Way Broaching Machine arranged for pull down operation. Indexing is automatic, and production rate is high.



MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

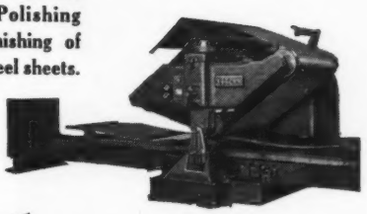
BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

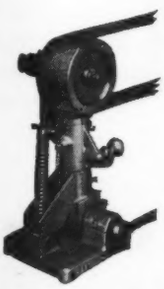
DIVISION OF S

MADE IN **ROCKFORD**... MACHINE TOOL SHOPPING CENTER ILLINOIS, U.S.A.

MATTISON
ABRASIVE BELT GRINDING AND POLISHING MACHINES

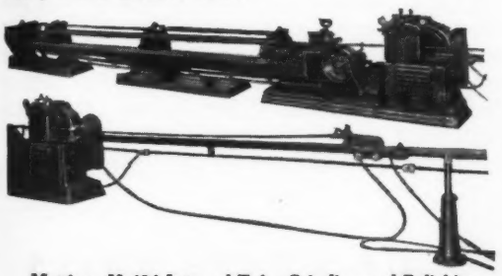
Mattison W-455 Wide Belt Grinding and Polishing Machine for finishing of wide stainless steel sheets.



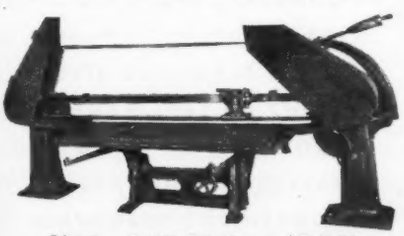


Mattison S-441 Grinding and Polishing Machine for flat and curved work. Can be furnished with or without special fixtures, depending on work ground. ➡

Mattison J-400 Backstand Idler adapts regular polishing Jack to the use of factory-coated abrasive belts.



Mattison H-424 Internal Tube Grinding and Polishing Machine for finishing inside of metal tubes.



Mattison L-138 Grinding and Polishing Machine arranged for wet grinding.

★ Results obtained in a number of plants definitely establish the use of factory coated abrasive belts as a most efficient practice. Besides reducing the number of rejections and improving the finish, they have cut the polishing cost per piece through increased production.

However, to secure full benefit from factory-coated abrasive belts, the right type of mechanical unit is necessary. The machine is all important for properly applying the abrasive to the particular job to be done.

Mattison Abrasive Belt Grinding and Polishing Machines are engineered with a knowledge of the factors involved to give the best application of belts. From the time factory-coated abrasive belts were introduced for metal grinding and polishing, Mattison's have developed and built machines to provide best results.

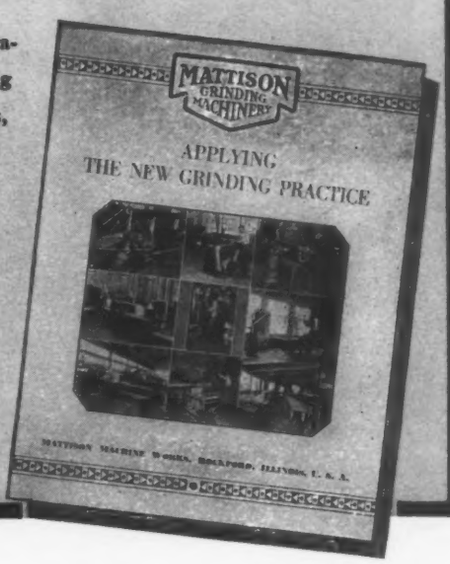
Mattison Abrasive Belt Grinding and Polishing Machines are used for smoothing up welding marks, polishing solid parts—such as handwheels, levers, handles, steel sheets including stainless steel—and the inside of tubes. They are built for both the wet and dry grinding method. In addition to the finishing of metal parts, they are used for plastics, hardened rubber, fibre, glass, etc. In fact, the applications are so numerous, only a few can be mentioned and shown on this page.

MATTISON GRINDING MACHINERY

Whatever your problems may be, it is well worth while to make an investigation as to the machine available for handling it.

SEND FOR *FREE* BOOKLET

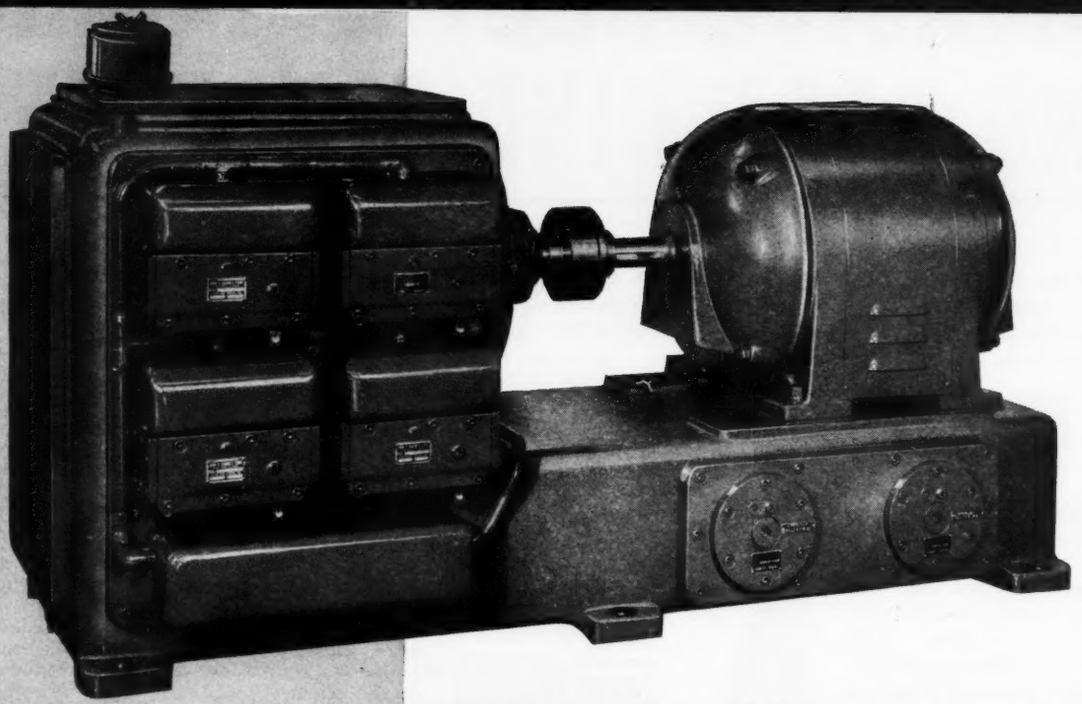
Illustrates various applications of Mattison Grinding and Polishing Machines, built to secure best results from factory-coated abrasive belts. Also gives helpful data on grinding and polishing metals, plastics and other materials with abrasive belts. Write today for your copy.



MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

MADE IN ROCKFORD MADE MEANS PRECISION MADE...ROCKFORD ILLINOIS, U.S.A.

BARNES L-TYPE HYDRAULIC UNITS



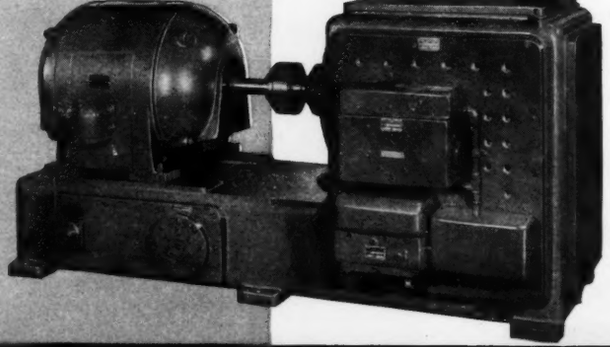
DESIGNED FOR FLEXIBILITY OF ARRANGEMENT AND A WIDE VARIETY OF APPLICATIONS...

Write for

THIS NEW CIRCULAR

Gives general description, details of construction, and principal engineering data on three standard sizes of BARNES L-Type Hydraulic Machine-Control Units.

Many different machine-control circuits can be built into the basic structure of this new hydraulic control unit, to provide almost unlimited versatility at moderate cost. Valves and piping connections *to suit YOUR individual application* are mounted as required on the side panels, with a direct-drive motor and pump of proper size. Three standardized sizes cover all needs from 2 to 15 horsepower. BARNES Hydraulic Units are delivered completely assembled and factory-tested, ready for easy and rapid attachment to your machine.



Rear view of unit shown above, illustrating additional valves and all piping connections arranged, in this instance, on the back panel.

Features OF L-TYPE UNITS

- COMPACT, SELF-CONTAINED
- DIRECT DRIVE TO PUMP
- THREE STANDARD SIZES
- RIGHT OR LEFT-HAND
- FOOT OR SIDE MOUNTING
- VALVES TO SUIT APPLICATION
- CONVENIENT TERMINALS
- PROTECTIVE FILTERS
- COMPLETE ACCESSIBILITY

John S. Barnes Corporation

325 South Water Street
ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS
ILLINOIS, U.S.A.

TODAY ...DESIGNED FOR A SPECIFIC JOB

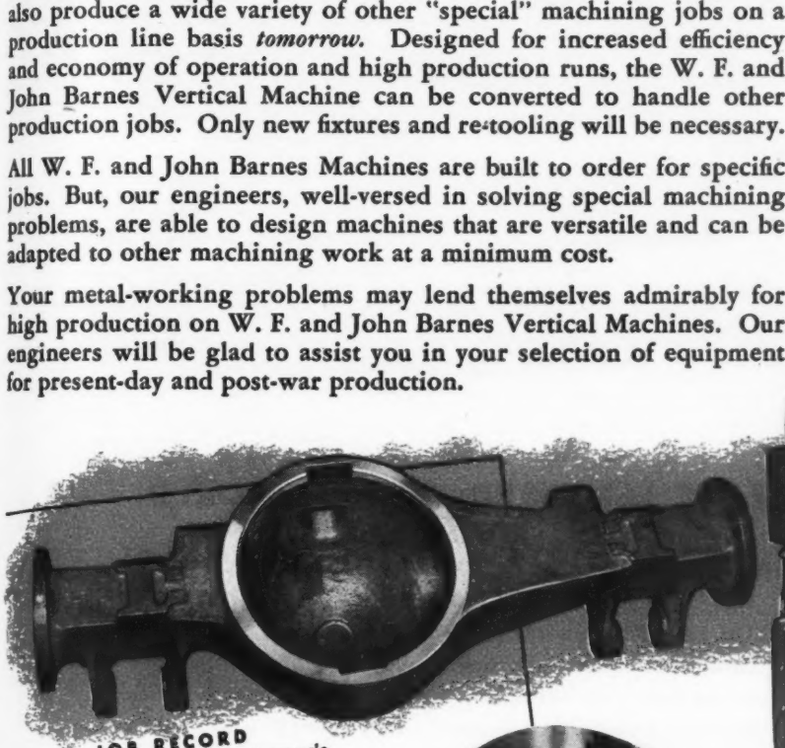
TOMORROW ...ADAPTABLE TO OTHER PRODUCTION

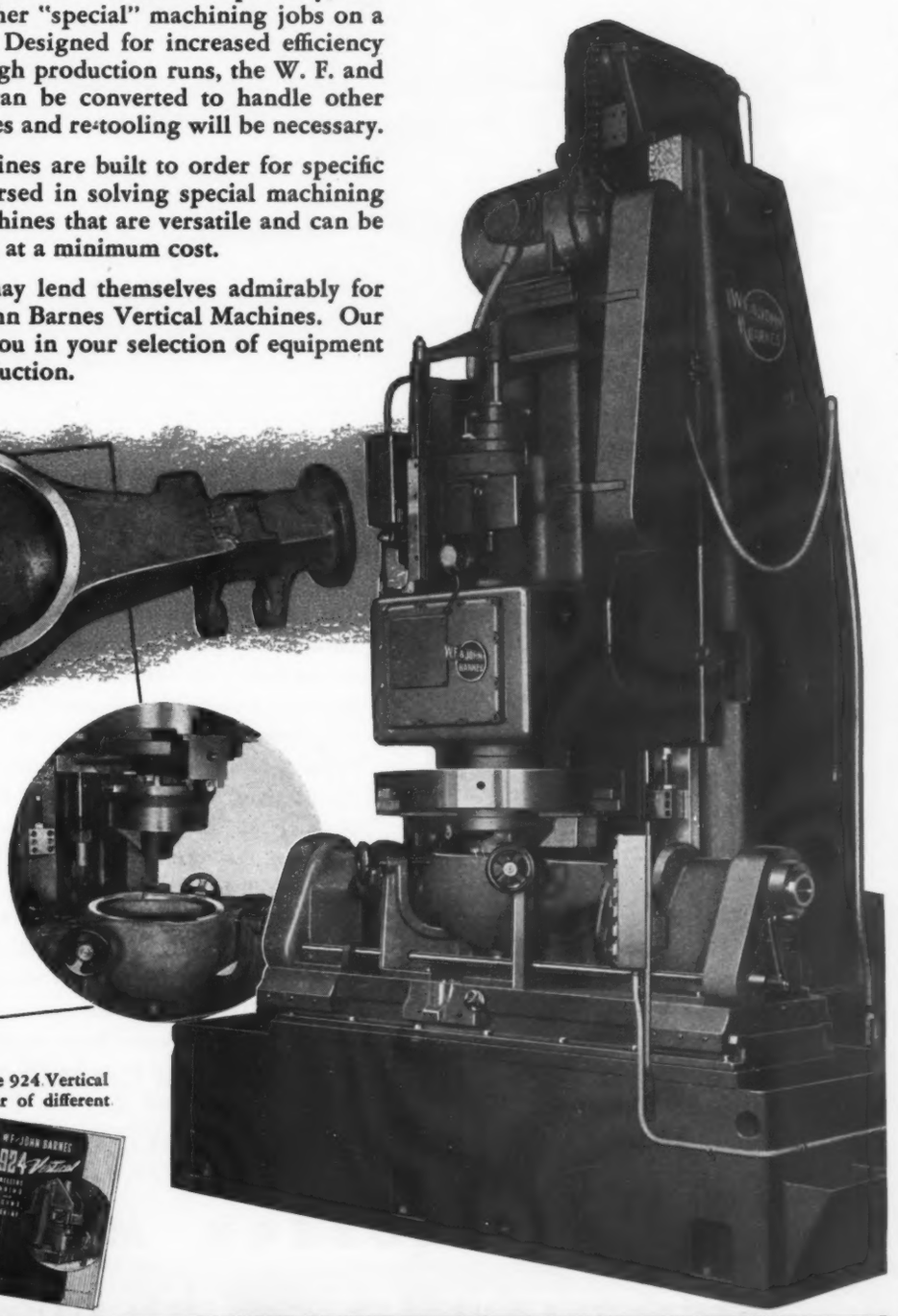
Conversion Costs Reduced To Minimum

Especially designed for a particular job *today,* the W. F. and John Barnes 924 Vertical Machine, because of its unusual adaptability, will also produce a wide variety of other "special" machining jobs on a production line basis *tomorrow.* Designed for increased efficiency and economy of operation and high production runs, the W. F. and John Barnes Vertical Machine can be converted to handle other production jobs. Only new fixtures and re-tooling will be necessary.

All W. F. and John Barnes Machines are built to order for specific jobs. But, our engineers, well-versed in solving special machining problems, are able to design machines that are versatile and can be adapted to other machining work at a minimum cost.

Your metal-working problems may lend themselves admirably for high production on W. F. and John Barnes Vertical Machines. Our engineers will be glad to assist you in your selection of equipment for present-day and post-war production.





JOB RECORD

In this well-known manufacturer's plant, the W. F. and John Barnes 924 Vertical Machine operates in a cycle of rapid approach, bore and chamfer to depth (positive stop), feed-out face and rapid return, with push-button remote control for starting the cycle.

The piece — an axle housing rough casting requires rough, semi-finish, finish boring and chamfering 15⅝" diameter; and rough, semi-finish and finish 17¾" diameter face. A special holding fixture supplied by the customer, facilitates this work. The entire time consumed for these various machining operations, performed on ONE W.F. and John Barnes Vertical Machine, is 7½ minutes.

Our four page bulletin illustrates how the 924 Vertical Machine has been applied to a number of different types of high production drilling, boring and facing operations. This is a bulletin you should have in your files — write for a copy today — Ask for Bulletin No. 345.

W.F. & JOHN BARNES

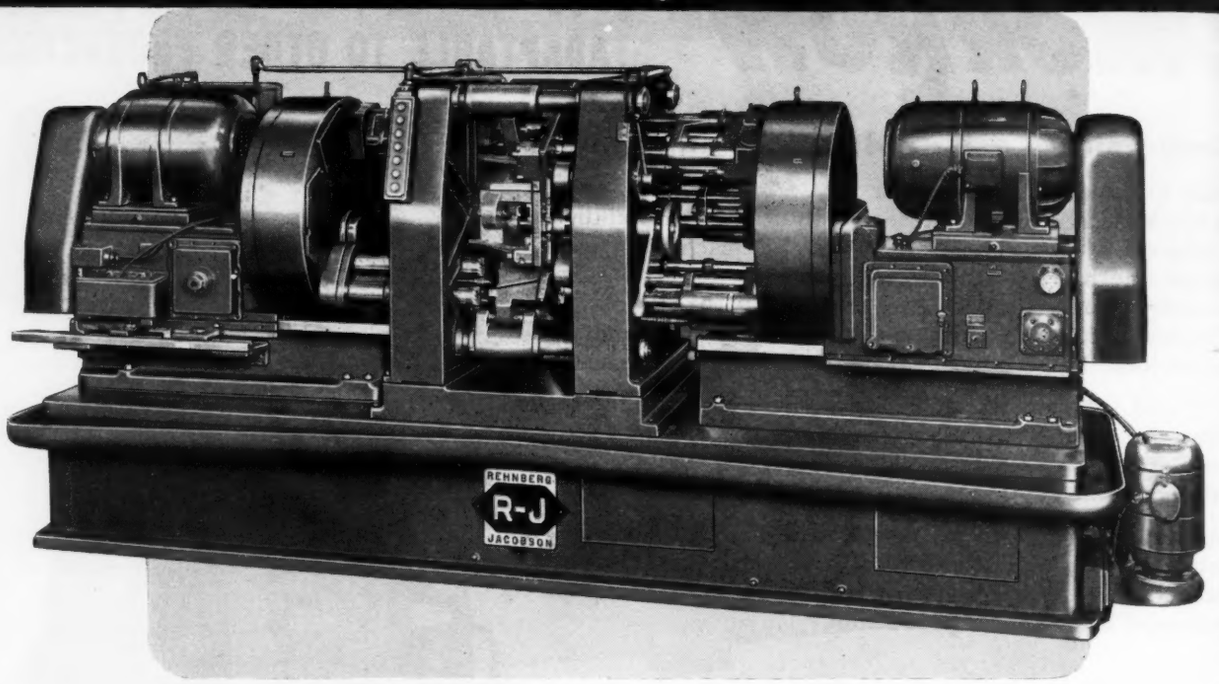
W. F. and JOHN BARNES

320 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD ILLINOIS, U.S.A.

Rehnberg-Jacobson



BOLT HOLES DRILLED, REAMED, CHAMFERED, COUNTERBORED, AND FACED IN CAP AND ROD SIMULTANEOUSLY ON DUPLEX MACHINE

The principal advantage of this set-up is that caps and rods go through the machine together, effecting equal production of these mating parts. One rod and one cap, on which the principal surfaces have been broached, are clamped in each fixture by a clutched hand wheel with auxiliary tightening lever. The fixture turret is manually indexed, and is positioned by a large lever-operated locking pin. Special heads, designed and built by Rehnberg-Jacobson and driven by W. F. & John Barnes units, advance from left and right. The right-hand head carries 20 spindles, 4 in each of 5 positions, which drill, redrill, rough and finish ream, and chamfer the bolt holes in both cap and rod. The left-hand head carries six heavy spindles, 2 in each of 3 positions, which offset counterbore and combination counterbore-and-chamfer the top rod shoulders, and face the cap shoulders. Traveling bushings and outboard bearings on the drilling and reaming spindles insure accuracy. The offset counterbore improves tool life on an ordinarily difficult cut. These rods and caps — which are used in a famous 4-cylinder engine — are produced at the rate of 180 each per hour in this machine.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

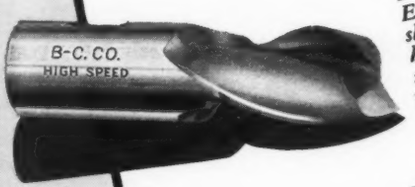
2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT
ILLINOIS, U.S.A.

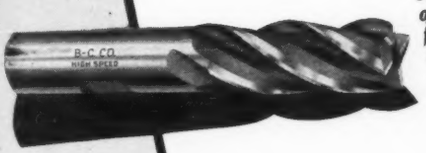
Here are *Fast* "SPIRALS" . . . for FASTER SLOTTING and PROFILING

Barber-Colman Fast-Spiral End Mills Produce Smoother Cutting Action, Eliminate Chatter

A Few B-C Fast-Spiral End Mills



Fast-Spiral Two Lipped End Mills will rapidly slot to depths of one-half cutter diameter in solid metal, without prior drilling operation.



Fast - Spiral Four Lipped End Mills will slot to depth equal to one-half diameter of cutter. Can enter cut from open end or drilled hole. The four lips permit use of a micrometer across blades when grinding to a given size. Also used for profiling.

Fast-Spiral Two Lipped Double End Mills permit sinking mill directly into solid metal without drilling. Cuts of depth up to ½ diameter of the mill easily taken. For slotting in solid metals and general end milling operations.

Fast-Spiral Four Lipped Double End Mills slot to depth equal to one-half diameter of cutter. Enter cut from open end or drilled hole. The four lips permit use of a micrometer across blades when grinding to a given size. When one end dulls, opposite end used by reversing it in holder. Also used for profiling.

Your slotting and profile milling can now be speeded, with positively finer finish, better chip separation and *longer tool life* with B-C Fast-Spiral End Mills. The high spiral flutes provide constant contact in the cut, eliminating vibration and chatter. The result is a faster smoother cutting operation . . . more profitable operation.

B-C Engineered End Mills are the most economical cutters available today for production slotting and profile milling. Low cost per piece milled is surely and easily obtained. They are accurately sharpened and hollow ground for keenest cutting edges. Their *correct design* and construction, under scientific metallurgical control, permit higher speeds, coarser feeds, and maximum chip load.

Barber-Colman Fast-Spiral End Mills, illustrated, are a few of the many standard cutters carried in stock, in a large variety of sizes, shanks, single or double end.

For fast slotting or profiling, where plunge cuts in solid metal or cuts starting from a drilled hole are required, here's your answer . . . Barber-Colman End Mills. They're good!

Your nearest B-C Field Engineer can show you how to adapt B-C End Mills to your particular jobs. Call on him . . . without obligation.

FIELD REPORTS AVAILABLE

MILLING CUTTER DATA, a loose leaf book which has important data on cutter feed and speed selection, sharpening information and stories of milling jobs taken in the field. Sent to all Key Production men upon request on company letterhead.

HOBBING MACHINES, HOBS, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

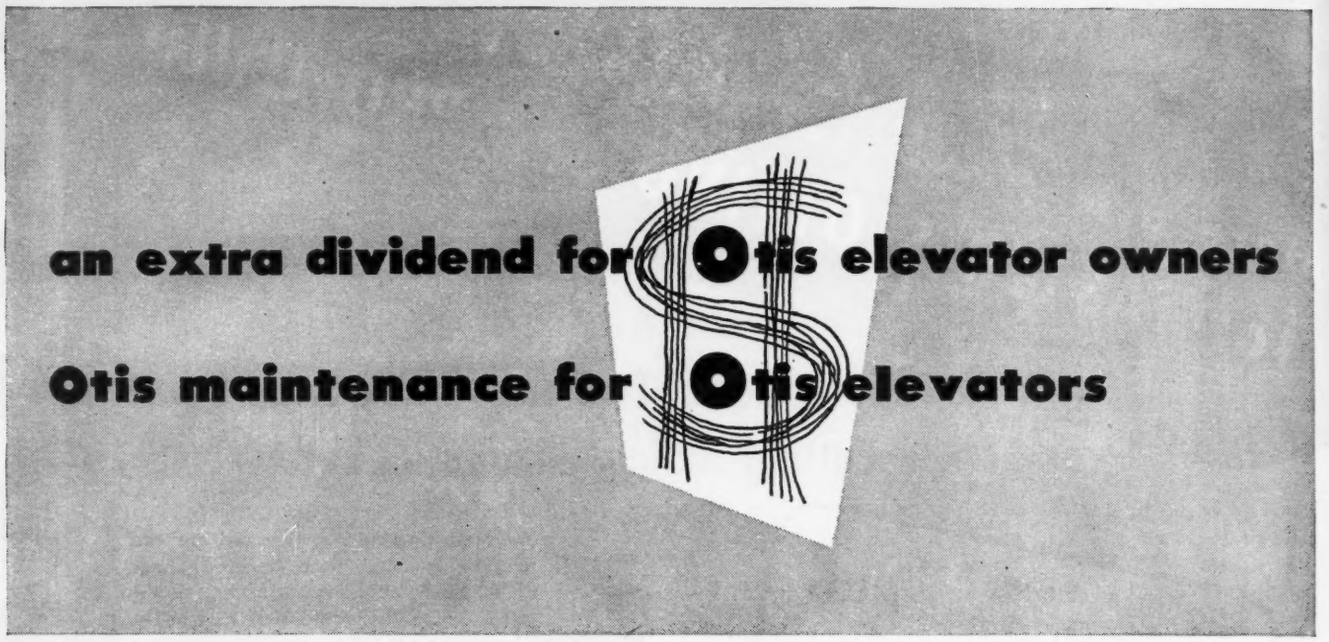
BARBER-COLMAN COMPANY

GENERAL OFFICES AND PLANT • 109 LOOMIS ST. • ROCKFORD, ILL., U.S.A.

BARBER B-C COLMAN

MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED...ROCKFORD ILLINOIS, U.S.A.



Otis Maintenance service is provided so quietly and with so little trouble to Otis elevator owners that many do not realize its true value to building management. ● Although it may not appear on the balance sheet, the value of this service may be measured in tenant satisfaction, more sales made or more freight moved, or in freedom from elevator care. It is especially valuable because of the spirit of the two thousand people who make up the Otis Maintenance organization. ● *Local* operations are conducted by 245 branch offices in 47 states, so that the men on the spot can act rapidly and effectively to give your building the best possible service. *District* and *zone* offices supervise field work and furnish supplies and emergency equipment. The *headquarters* organization provides all of the facilities and technical knowledge of the manufacturer. ● The service rendered is of such real and constant value that Otis Maintenance has more than doubled in volume every ten years. It could not thus increase without bringing the customers more than a dollar's worth of service value for every dollar spent. ● Otis Maintenance is a complete, flat-rate service for Otis elevators. It is available through your local Otis Elevator Company office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

Ryerson Ingenuity Provides Service

Despite Steel Shortage!

It is true that today many kinds and sizes of steel are not always immediately available and there will be many of your inquiries and orders we cannot handle. But your Ryerson salesman knows the ins and outs of steel procurement and it is surprising what can be accomplished by close cooperation between us.

We may be able to suggest an alternate type or analysis that will serve, or a larger size that can be cut or machined to meet your requirements. Flame cutting or forming, welding and other fabricating processes often enable us to come through and help you complete a needed product.

We believe the steel shortage may ease somewhat during the coming months. But in the meantime we want you to know that our whole organization is carrying on; doing everything within its power to help every customer secure the steel he needs. We urge you to keep in touch with us.

RYERSON STEEL

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston

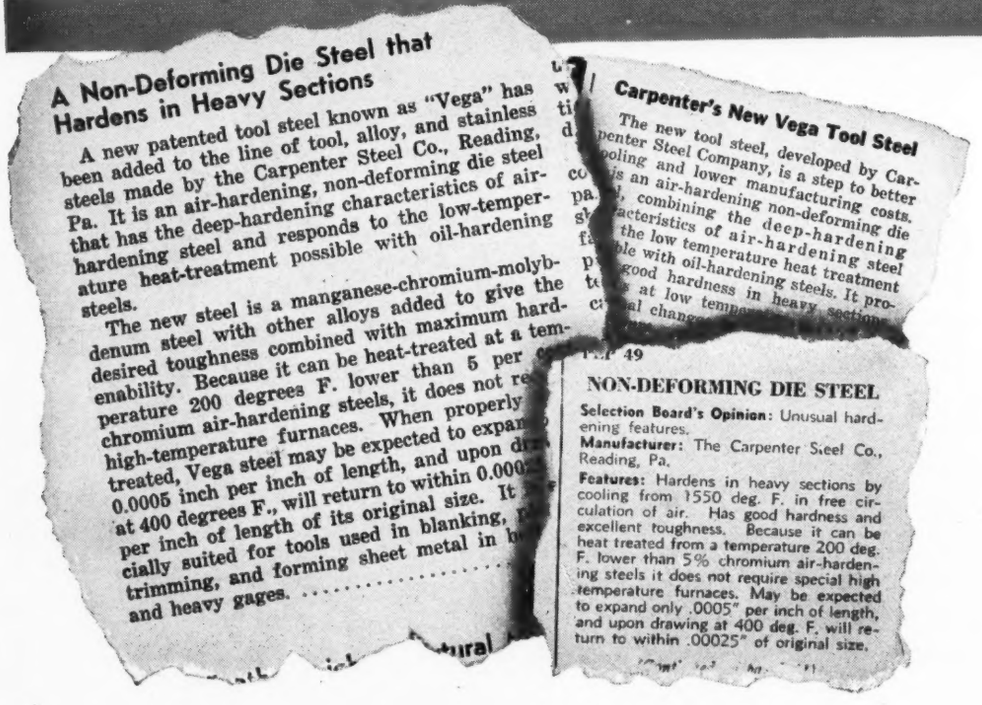
VEGA

U. S. Pat. 2,355,224

here is the NEW

AIR-HARDENING TOOL STEEL

that gives you



A Non-Deforming Die Steel that Hardens in Heavy Sections

A new patented tool steel known as "Vega" has been added to the line of tool, alloy, and stainless steels made by the Carpenter Steel Co., Reading, Pa. It is an air-hardening, non-deforming die steel that has the deep-hardening characteristics of air-hardening steel and responds to the low-temperature heat-treatment possible with oil-hardening steels.

The new steel is a manganese-chromium-molybdenum steel with other alloys added to give the desired toughness combined with maximum hardenability. Because it can be heat-treated at a temperature 200 degrees F. lower than 5 per cent chromium air-hardening steels, it does not require high-temperature furnaces. When properly treated, Vega steel may be expected to expand only 0.0005 inch per inch of length, and upon drawing at 400 degrees F., will return to within 0.0002 inch per inch of length of its original size. It is especially suited for tools used in blanking, piercing, trimming, and forming sheet metal in both thin and heavy gages. . . . . .

Carpenter's New Vega Tool Steel

The new tool steel, developed by Carpenter Steel Company, is a step to better cooling and lower manufacturing costs. It is an air-hardening non-deforming die steel, combining the deep-hardening characteristics of air-hardening steel with the low temperature heat treatment possible with oil-hardening steels. It produces good hardness in heavy sections at low temperatures . . . . . minimum dimensional change . . . . .

. . . . . P. 49

NON-DEFORMING DIE STEEL

Selection Board's Opinion: Unusual hardening features.

Manufacturer: The Carpenter Steel Co., Reading, Pa.

Features: Hardens in heavy sections by cooling from 1550 deg. F. in free circulation of air. Has good hardness and excellent toughness. Because it can be heat treated from a temperature 200 deg. F. lower than 5% chromium air-hardening steels it does not require special high temperature furnaces. May be expected to expand only .0005" per inch of length, and upon drawing at 400 deg. F. will return to within .00025" of original size.

This folder contains complete information on VEGA—its properties, heat treatment and use. To put VEGA's new advantages to work in your tool room ask for the new VEGA folder. Just drop us a note on your company letterhead, indicating your title.

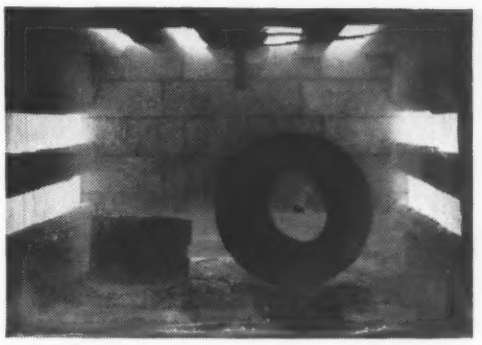
Carpenter AIR-HARDENING TOOL STEELS
100% ACID-DISC INSPECTED

Branches at: Buffalo • Chicago • Cincinnati • Cleveland • Dayton • Detroit • Hartford • Indianapolis • New York • Philadelphia • Providence • St. Louis

EASY, LOW-TEMPERATURE HEAT TREATMENT

1

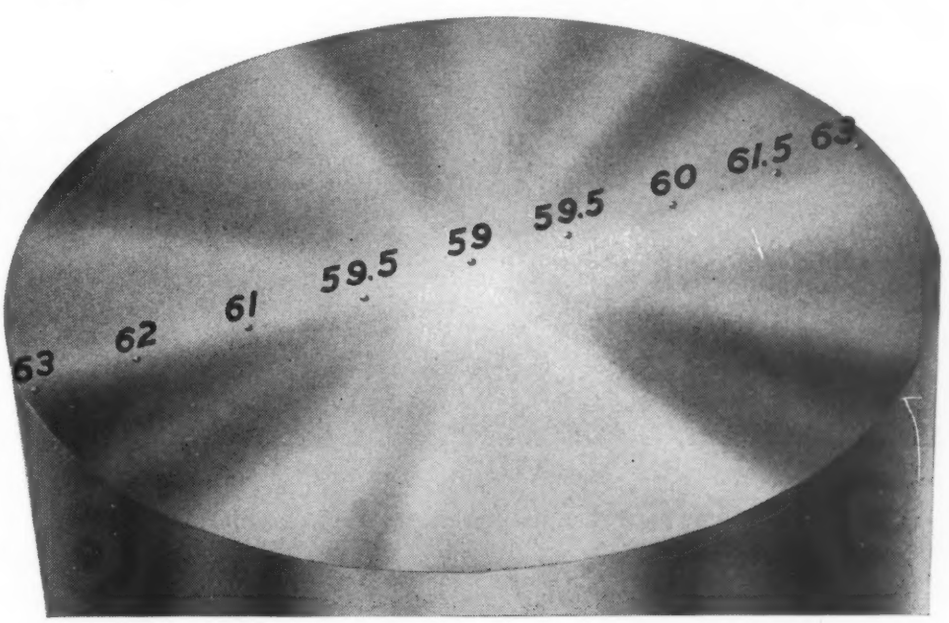
The fact that VEGA can be heat treated from a temperature 200° F lower than the 5% chromium air-hardening steels often eliminates the need for expensive pack hardening to avoid excessive scaling. And because the hardening temperature for VEGA is only 1550° F, no special high temperature furnaces are required. These two advantages alone enable VEGA to do more than "pay its way" in your tool room.



UNIFORM HARDENING IN VERY HEAVY SECTIONS

2

This new steel combines the deep-hardening characteristics of air-hardening steels with the simplicity of *low temperature* heat treatment. Notice the uniformity of Rockwell hardness values from surface to center of this 8" VEGA round. On your jobs such as blanking, piercing, trimming and forming sheet metal in light and heavy gauges—jobs where minimum distortion and size change, uniform hardening in very heavy sections are required—VEGA gives you long tool life, low production costs.



Inside Rockwell "C" Hardness of Section Cut Midway on 8" Round x 15" Long VEGA. Air Cooled at 1550°F 1 Hour at Heat.

CHECK THESE EXTRA ADVANTAGES YOU GET WITH VEGA

- ✓ *Minimum Distortion and Size Change*
- ✓ *Resistance to Decarburization*
- ✓ *Freedom from Excessive Scale in Hardening*
- ✓ *Good Machinability*
- ✓ *High Degree of Toughness with Good Hardness to Resist Shock and Wear*

THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.

LOOK

More and more manufacturers of screw machine products are recognizing the advantages of Alcoa Aluminum Screw Machine Stock. Its economy means lower cost—greater profits. It can be worked at top machine speeds. It produces a fine finish. Prices are lower than pre-war. And—there's plenty available, assuring prompt shipment. Phone Alcoa's nearby office.

ALUMINUM COMPANY OF AMERICA, 1748 Gulf Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

America's Leading Source of 52100 High Carbon-Chrome Steel

. . . for these good reasons:

The Timken Roller Bearing Company through its Steel and Tube Division:

—pioneered the production of 52100 tubing.

—is the world's largest producer of 52100 tubing.

—is the only source of 52100 steel in the three finished forms; tubes, bars and wire.

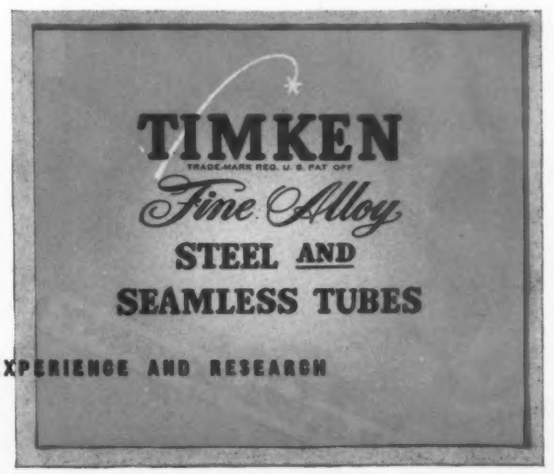
—has direct control of quality from melting to final inspection.

—has the world's largest battery of controlled atmosphere furnaces for annealing 52100 steel — thus assuring minimum decarburization and maximum machinability.

—has consistently led the industry in the development and application of 52100 steel for those machined parts where an oil hardening steel of good wear resistance is required.

These advantages coupled with a thorough-going Job Analysis Plan and follow-through to final use in customers' plants, assures your complete satisfaction. Write or phone Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

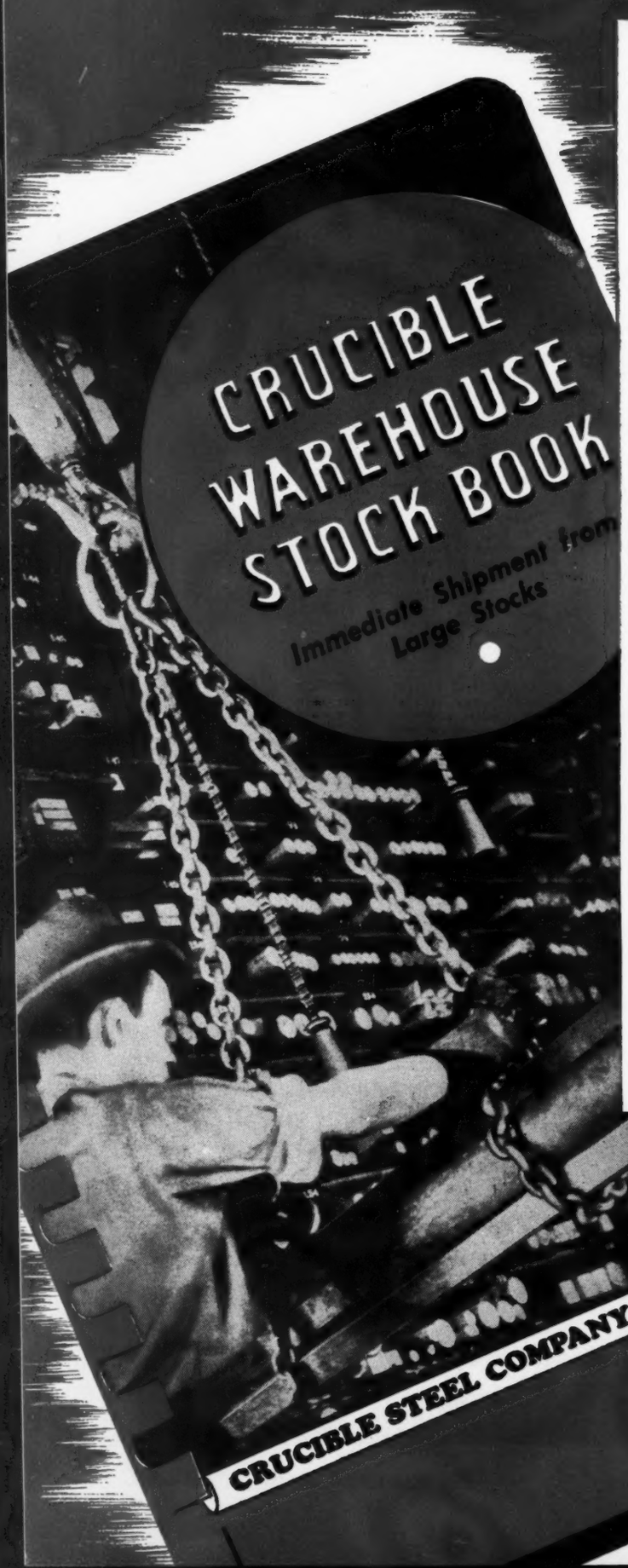
ONLY TIMKEN MAKES ALL THREE PRODUCTS
52100 forging bars and billets in a complete range of sizes. Machining bars in hot rolled annealed, cold drawn, turned or centerless ground finish.
52100 tubing from 1" O.D. to 10" O.D. in a wide range of wall thicknesses, and in hot rolled annealed, cold drawn, turned, centerless ground and Roto-rolled finishes.
A mill warehouse stock of 99 popular sizes is available for immediate shipment.
52100 wire in coils in sizes up to 3/4" round, hot rolled, hot rolled annealed, and cold drawn for hot and cold heading applications and other uses where coil stock is suitable.



YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS in hot rolled and cold finished Alloy Steels for forging and machining applications, as well as a complete range of Stainless, Graphitic and Standard Tool Steel analyses. Also Alloy and Stainless Seamless Steel Tubing for mechanical and pressure tube applications.

FREE HANDY STOCK BOOK



Lists Crucible's FULL-RANGE of specialty steels—

HIGH SPEED • ALLOY • STAINLESS
MACHINERY • TOOL • SPECIAL PURPOSE

all obtainable promptly from Crucible's 26 warehouses.

●

The CRUCIBLE WAREHOUSE STOCK BOOK contains:

1. Working instructions, tables, and other reference material that will be helpful in specifying, fabricating, and heat-treating quality steels.

2. Crucible's FULL-RANGE stocks of specialty steels under these groupings . . .

Rexalloy Cast Cutting Tools	**Drill Rods**
High Speed Steels	**Stainless Steels**
Hot Work Steels	**Alloy Steels**
Oil Hardening Tool Steels	**Machinery Steels**
Air Hardening Tool Steels	**Drill Steels**
Water Hardening Tool Steels	**Miscellaneous Steels**

3 advantages of ordering all of your specialty steels from Crucible's FULL-RANGE warehouse stocks.

Will simplify and centralize your steel buying... reduce inventory...save time and money.

1 CONVENIENCE AND TIME SAVING

No additional orders or 'phone calls to other suppliers—only one handling in the Receiving Department—less paper work in checking and paying the bill.

Crucible's FULL-RANGE warehouse service may make it possible for you to carry a lower steel inventory.

2 QUALITY AND UNIFORMITY

Crucible relies on its *own mills* for direct stock replenishment. It operates its *own* warehouse distribution system in conjunction with its manufacturing program. Thus, Crucible customers are assured that each lot received is of uniform top quality—will give a maximum of production efficiency.

3 SERVICE ENGINEERS AVAILABLE

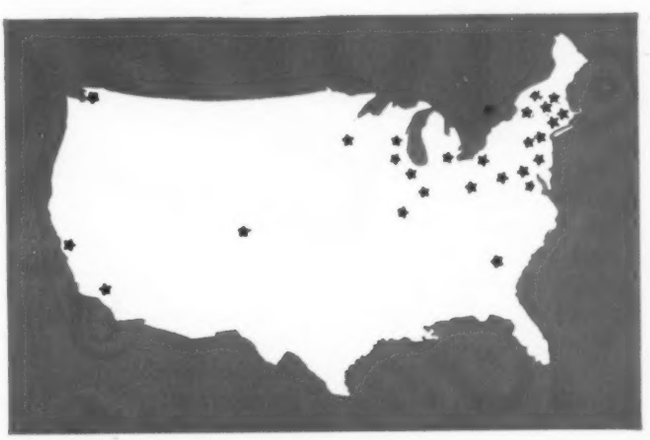
In Crucible's Advisory Service at each warehouse you have available the services of trained, experienced, practical steel men who will cooperate with you in the selection and application of the best steels for every production purpose. In addition, mill metallurgists are available for consultation.

The Crucible steel man at the warehouse near you can help you select not only the right production steel but also the right cutting or die steel for use in fabricating your particular product.

The men who make Crucible steels know what each type is best for.

We'll be glad to send you a CRUCIBLE WAREHOUSE STOCK BOOK which lists the FULL-RANGE specialty steel stocks available at the 26 Crucible warehouses. It contains helpful reference data, and describes in detail the full Crucible service facilities available to you.

The Coupon, clipped to your company letterhead, will bring your free copy.



★ Crucible's Branch Warehouses and Sales Offices

FREE

Crucible Steel Company of America
Dept. C-2, 405 Lexington Ave., N. Y. 17, N. Y.

Kindly send me a copy of the CRUCIBLE WAREHOUSE STOCK BOOK:

NAME_____ TITLE_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

CRUCIBLE STEEL COMPANY Full-Range Service **of America**

Chrysler Building, 405 Lexington Ave., New York 17, N. Y. • Branches, Warehouses, and Distributors in Principal Cities

Consult Telephone Directory or Thomas' Register for Nearest Office

Quick Delivery

JOHNSON UNIVERSAL BRONZE
1 3/8 x 2 1/4 JOHNSON UNIVERSAL NEW CASTLE PA USA
JOHNSON UNIVERSAL BRONZE
JOHNSON UNIVERSAL NEW CASTLE PA USA 1 1/2

Johnson UNIVERSAL BRONZE BARS

Something New!

Every Johnson UNIVERSAL Bronze Bar now carries the size, stamped on the bar. This will eliminate confusion and help prevent mistakes.

● Here is great news for every type of industry. Due to increased facilities we can now supply all your requirements in Johnson UNIVERSAL Bronze Bars—*from stocks*—conveniently located. Simply check your local phone book . . . classified section, under Bronze. There you will find the name and number of your local Johnson Bronze Distributor.

The demand for Johnson UNIVERSAL Bronze has grown by leaps and bounds. Users have found that when they specify *Johnson* they get the highest quality available. Quality that means years of smooth, efficient, bearing performance.

Why not check over your requirements right now? Then call in your local distributor. Permit him to show you the excellent service available. The bronze will prove its quality through long bearing life.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
520 S. MILL STREET NEW CASTLE, PA.

The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD

You can postform plastic laminates READILY–ECONOMICALLY

POSTFORMING adds a new dimension to the fabrication of laminated plastics. This important advance proved its value for many vital war applications. Now, it enables the laminated plastics industry to meet on favorable terms the forming costs of other materials—creates a wealth of new opportunities for the commercial application of laminates.

Postforming capitalizes on the latest thermoelasticity of laminated plastics—converts flat sheets of high- and low-pressure laminates into a vast variety of shapes with simple or compound curves. After heat-softening, the thermosetting stock is cold-formed in wooden, plywood, densified wood, or metal dies or jigs. It can then be readily drilled, sawed, punched, and machined. Finished products are lightweight, dimensionally stable, and have high impact and tensile strengths.

The exceptional electrical and mechanical properties of plastic laminates—their low initial and low postforming costs—offer designers and manufacturers vast scope for product improvement and production economy. Write Department **39** for further information on this new postforming technique. And ask, too, for our comprehensive booklet C-1, "Bakelite Laminating Plastics."

BAKELITE PLASTICS

TRADE-MARK

TRADE-MARK

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 EAST 42ND ST., NEW YORK 17, N. Y.

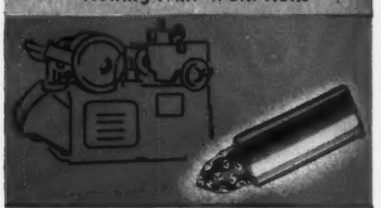
TALIDE METAL MEETS EVERY REQUIREMENT

Talide
(TUNGSTEN CARBIDE)
Performance!

Lathe and Grinder Centers

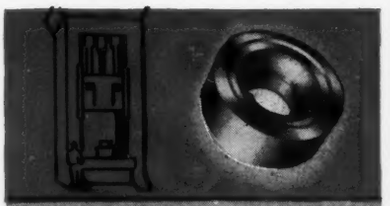
Centerless Blades

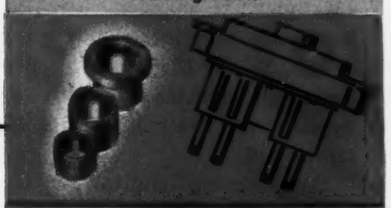
Rolling Mill Work Rolls


Diamond Wheel Dressers

A FEW MAJOR USES FOR TALIDE METAL

Cutting Tools


Sheet Metal Dies


Drill Jig Bushings

the hardest metal made!

Plug and Ring Gages

Wire and Tube Drawing Dies

On any cutting, drawing, or wear resistance application, you can increase production many times and cut costs as much as half. Cutting tools of Talide cut 2 to 3 times faster than high speed tool steel. Talide drawing dies and wear resistance parts usually outwear steel by at least 50 to 1.

Send us parts or prints and we will show you how this hardest man-made metal can improve your production. If you prefer, a Talide sales engineer will call at your office.

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

TALIDE

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

Take a tip from a windshield wiper

—nothing equals Stainless Steel!

Made of U·S·S Stainless Steel, these parts weigh exactly one ounce. Clever engineering makes them less costly to manufacture, longer lasting, more attractive to the buyer.

When you drive home tonight take a look at your windshield wipers. The chances are they're more than four years old. What do they look like now? If they're still shiny and bright, free from rusty stains and pitting you can be pretty certain that they're made of Stainless Steel.

How much *more* do you think it cost to make them of stainless? We're willing to bet it cost nothing extra. Why? Because parts like these form faster and easier in Stainless Steel. They don't have to be plated either. And—because Stainless Steel is so tough and strong—thinner, lighter sections can be used to do the job.

"So what?" you say, "We're not making windshield wipers." Maybe not, but listen to this. The same good reasons that make Stainless better for them, make Stainless Steel better for thousands of similar everyday products where superior mechanical performance, greater endurance, and permanent beauty can be assured at little or no increase in cost.

Admittedly there are many applications where the use of Stainless Steel does add to *first* cost. But here again the money-saving benefits it assures—(1) practical immunity to corrosion, (2) unsurpassed resistance to heat, wear and abrasion, (3) endurance far beyond the ordinary, (4) easy cleaning, (5) beauty that will not fade—all add up to make Stainless Steel the most economical of all materials to use. And remember also, the extra sales appeal Stainless adds to your product can't be measured in dollars and cents.

Build it of Stainless Steel—and for best results build it of *U·S·S* Stainless—a *perfected, service-tested steel* that is available in the most complete range of analyses, sizes, forms and surface finishes anywhere obtainable. If you need help in its application, our specialists will be glad to work with you.

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Supply Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

USS STAINLESS STEEL — UNITED STATES STEEL

UNITED STATES STEEL

in daily use

in all common forms

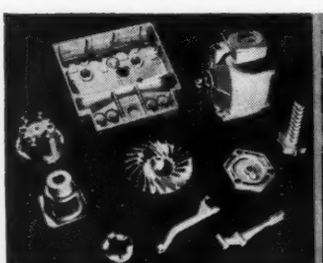
Whatever your needs may be, there's an available magnesium form for every standard purpose. Like other firms throughout the country, you'll find it pays to adapt magnesium's lightness, strength, machinability to the job of cutting costs and improving products in your own field.

Today magnesium alloys are freely available in all common forms—ingots and billets; sand, permanent mold, and die castings; forgings; extruded bars, rods, shapes, and tubing; and rolled sheet, plate, and strip. Commercially pure magnesium and such special products as welding rod, protective agents, fluxes, and special alloys are also readily available. As the pioneer producer and leading fabricator, Dow offers complete technical data and assistance in working and fabricating magnesium. Simply contact the nearest Dow office.

Ready... to make products move!

MAGNESIUM

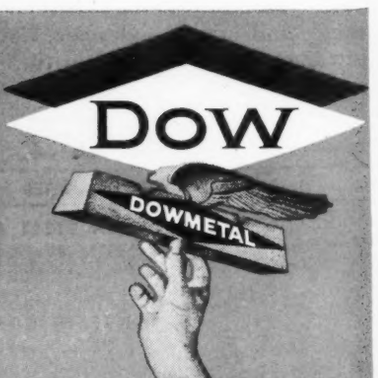
LIGHTEST OF ALL STRUCTURAL METALS



Die casting magnesium is an accepted method of producing lightweight parts with good surfaces and close dimensional tolerances.

Preheated magnesium sheet is readily deep drawn in a single operation, without need for repeated annealing and redrawing.

Sand and permanent mold castings of magnesium are known for their exceptional combination of lightness, soundness, strength.



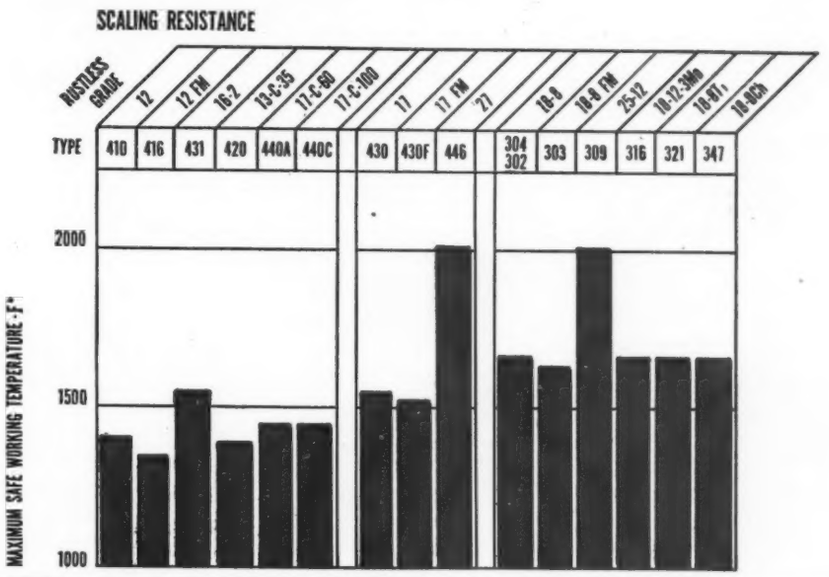
MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

RUSTLESS DATA SHEET NO. 5

Corrosion Resistance Plus Resistance to Scaling at High Temperatures

One of the Many Combinations of Properties Offered by Stainless Steels



IN A SENSE, corrosion, oxidation and scaling are all the same. Scaling or oxidation is merely an accelerated form of corrosion taking place at high temperatures. Each produces the same result—reduction of the effective body of a part with consequent reduction in its physical strength and performance. The continuous performance of stainless steels at high temperatures in highly corrosive atmospheres is responsible for their extensive use in heat exchangers, industrial furnace supports, domestic stove and heater parts, valve stems, valves, torch heads on cutting and welding equipment, exhaust stacks, jet and gas turbine parts for aircraft.

Stainless steels, like other materials, vary in their resistance to corrosion and high temperature scaling. The above chart was prepared from data obtained by heating polished samples in ordinary slightly oxidizing furnace atmospheres, using circulating air as in the case of electric furnaces. It indicates that alloys lower in chromium, such as Types 410 and 416 (12% chromium) resist scaling up to approximately 1400°F. Higher chromium and high chrome-nickel grades such as Types 446 and 309 (25-27% chromium) withstand the withering effects of 2000°F. Ordinary steel scales at about 900°F. Thus, the remarkable property of stainless steel is that when the chromium content is increased, resistance to scaling is increased. Type 446 (Rustless 27) should be used for high temperature service only when stresses are low; whereas Type 309 (Rustless 25-12) can be used when conditions require high tensile strength combined with resistance to scaling and corrosion.

At high temperatures most commonly used metals and alloys form weak, porous scale which flakes off, opening the way for progressive deterioration. Stainless steels are different. Scale is tough, impervious, and strongly adherent, and offers protection against further attack. When you want to know more about the properties of stainless steels at any temperature . . . ask the leading specialists in stainless steels . . . call on Rustless.

If you have been confronted with a confusion of trade names of various stainless steels and would like to relate all producers' commercial designations with standard AISI type numbers, government specifications, and ASTM standards, write for Rustless' handy chart entitled, "TRADE NAMES OF STAINLESS STEELS."

SALES OFFICES:
ATLANTA • BALTIMORE • BERKELEY • BOSTON
BUFFALO • CHATTANOOGA • CHICAGO
CINCINNATI • CLEVELAND • COLUMBUS
DALLAS • DAYTON • DETROIT • HOUSTON
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Rustless

DIVISION OF ARMCO

RUSTLESS IRON AND STEEL DIVISION
THE AMERICAN ROLLING MILL COMPANY
Baltimore 13, Maryland
STAINLESS STEEL SPECIALISTS

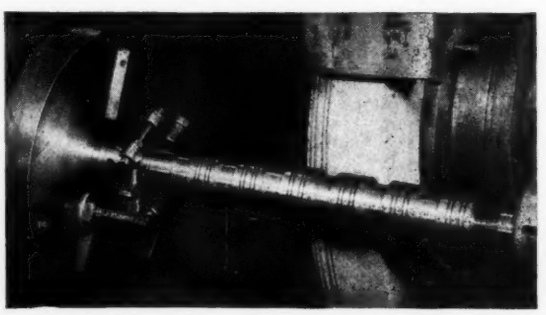
You notice the **IMPROVED RESULTS** immediately when your machining and grinding **COOLANTS** are made up with

OAKITE SOLUBLE OIL

Year after year, in plant after plant, exacting tests and continued use have verified the many advantages this high quality soluble oil provides on various MACHINING and WET GRINDING operations. Where economy, precision work and speed are prime production requirements, you too, will find Oakite Soluble Oil helps step-up output and cut costs on a wide variety of metals where COOLANTS are indicated.

11 Advantages on MACHINING Operations:

1. Economical because of high dilution ratio
2. Precision work
3. Better finish
4. Extends tool life
5. Chatter-free, clean cutting action at point of tool
6. Production at rated capacity of machine
7. Provides stable, well-balanced emulsion
8. Resistance to rancidity
9. Rust preventing properties
10. Long coolant life
11. Keeps supply lines clean



Crush Dressed Wheel Grinding

If you are grinding with crush dressed vitrified wheels, make up your coolant with Oakite Soluble Oil in recommended dilution. It contributes to fine finish precision work, gives ample cooling and lubrication. Arrange to make a test in your plant. See for yourself the advantages Oakite Soluble Oil provides. Write today for our Service Representative to call. There is no obligation.

OAKITE PRODUCTS, INC.

34E Thames Street, New York 6, N. Y.

Technical Service Representatives in Principal Cities of the U. S. and Canada

11 Advantages on WET GRINDING Operations:

1. Keeps wheel clean and free-cutting
2. Fine precision finishes
3. Provides maximum cooling and lubricity
4. Conserves diamonds . . . fewer wheel dressings
5. Coolant emulsion is stable
6. Resistance to rancidity
7. Rust preventing properties
8. Quick settling out action
9. Keeps supply lines clean
10. High dilution ratio
11. Economical

6 years prove

YOUR HACK SAW BLADE MAKER CAN GIVE YOU MORE OF ALL 4!

by using

INGERSOLL D-B-L STEEL

1 Tough cutting edge
2 High impact resistance
3 Relative freedom from decarburization
4 Lower cost

INGERSOLL D-B-L* HACK SAW STEEL

Whichever type you prefer, Ingersoll D-B-L Hack Saw Steel has a 6-year record of wide use behind it to PROVE that you get more of all 4!

INGERSOLL STEEL DIVISION

Borg-Warner Corporation • *New Castle, Indiana*

Plants: New Castle, Indiana; Chicago, Illinois; Kalamazoo, Michigan

*Furnished in the original D-B-L Regular,—"5-4" and D-B-L 2,—"6-5"

ENGINEERING B-W PRODUCTION

INGERSOLL SPECIAL STEELS FOR SPECIAL USES

Alloy Steels
Armor Plate
Clutch Plate Steels
Tillage Steels
Soft Center Steels
Shovel Steels
Knife Steels
TEM-CROSS Steel
IngAclad (Stainless-Clad Steel)
Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels

CR-MO-W

CHROME MOLY TUNGSTEN

A HOT-WORK TOOL STEEL

with HIGHER hardness, BETTER impact properties

That's a thumbnail description of Bethlehem's Cr-Mo-W . . . so named because three of its most vital elements are chromium, molybdenum, and tungsten. Essentially a hot-work die steel, it has several outstanding traits, among which are the following:

- In heat-treatment it can develop a hardness 3 to 5 points higher than the average hot-work steel.
- With this higher hardness go better impact properties and abrasion-resistance.
- The carefully-controlled carbon-silicon content guards against heat-checking.

You'll find, too, that Cr-Mo-W retains its hardness and other desirable properties at elevated temperatures, even under adverse working conditions.

Use it for hot header and gripper dies; hot upset and piercing punches, shear blades, and trimmer dies; casting-dies for tin, zinc, aluminum, magnesium, lead, white metal, etc.

TYPICAL ANALYSIS

C	Mn	Si	Cr	Mo	W
.33	.33	1.05	5.00	1.65	1.55

★ BETHLEHEM STEEL ★

CUMBERLAND GROUND SHAFTS

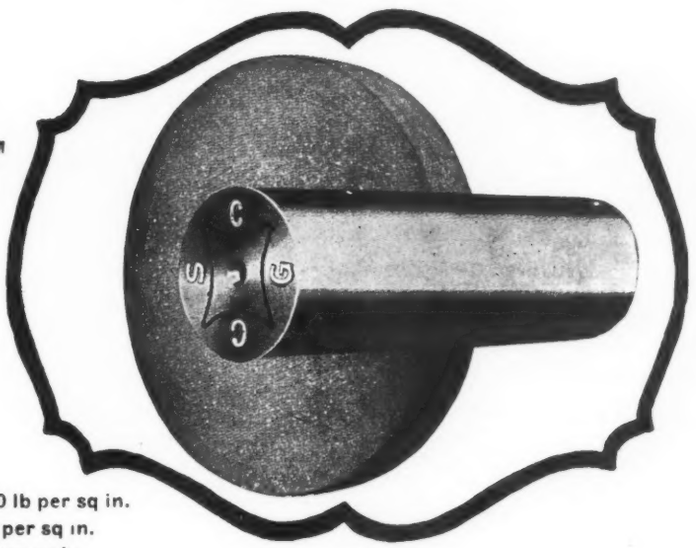
An Exclusive Product made by an Exclusive Method

DIAMETERS 1-1/8" to 8" INCLUSIVE

•

MINIMUM ELASTIC LIMIT

Cumberland Brand—30,000 lb per sq in.
Potomac Brand—45,000 lb per sq in.
Cumsco Brand—55,000 lb per sq in.



CONCENTRIC STRAIGHT ACCURATE

•

MAXIMUM LENGTHS MANUFACTURED

Year 1845—up to 16 feet
Year 1886—up to 25 feet
Year 1945—up to 70 feet

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired.

•

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CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

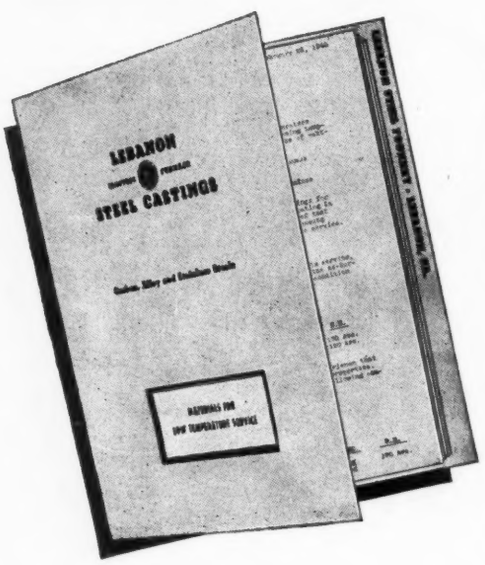
THE TEMPERATURE RANGE:

32°F to -300°F and below

THE RECOMMENDED ALLOYS:

Ⓛ 19... Ⓛ 22... Ⓛ 205

Send for Complete Low Temperature File!



Gives Chemical Analyses . . . Physical Characteristics . . . Impact Values

The folder illustrated was designed to be slipped in your file "as is." It comes to you as a complete, permanent, easy-to-find, easy-to-use data file on Lebanon Circle L 19 . . . L 22 and L 205. All data has been exhaustively tested. Information includes chemical analyses of both ferritic and austenitic type materials, physical characteristics, Keyhole and "V" Notch Charpy impact properties at various temperatures. Write today for your free copy.

STEELS to be used in castings for low temperature service should be carefully chosen. Wide application has tested and proved three Lebanon alloys . . . Ⓛ 19 . . . Ⓛ 22 and Ⓛ 205.

Lebanon Circle Ⓛ 19 and Ⓛ 205 are ferritic steels for service to −150° F. Circle Ⓛ 22 is an austenitic alloy for service below −150° F. These materials are the products of the special attention Lebanon has given to low temperature service conditions. Lebanon is at present conducting a series of additional tests on alloy steels suitable for temperatures below freezing.

Studies of *individual* service conditions are also gladly undertaken by Lebanon. A study of this type is the surest way to select the steel best fitted to your requirements. Lebanon foundry engineers and metallurgists are ready to confer with you on any steel or alloy castings application.

LEBANON STEEL FOUNDRY
LEBANON, PA.
"In the Lebanon Valley"

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

Lebanon CIRCLE L ALLOY AND STEEL Castings

Write for Bulletin 194. Gives complete data on Cramp ferrous and non-ferrous alloys.

When you are designing cast parts that must have high strength and withstand severe service, Cramp Alloy No. 257 can do the job for you. It is made in various grades by a special process of manufacture, whereby the graphite is in small evenly distributed veins with the matrix of fine pearlite. The long experience and complete facilities of Cramp foundries assure sound, uniform castings true to size and specification.

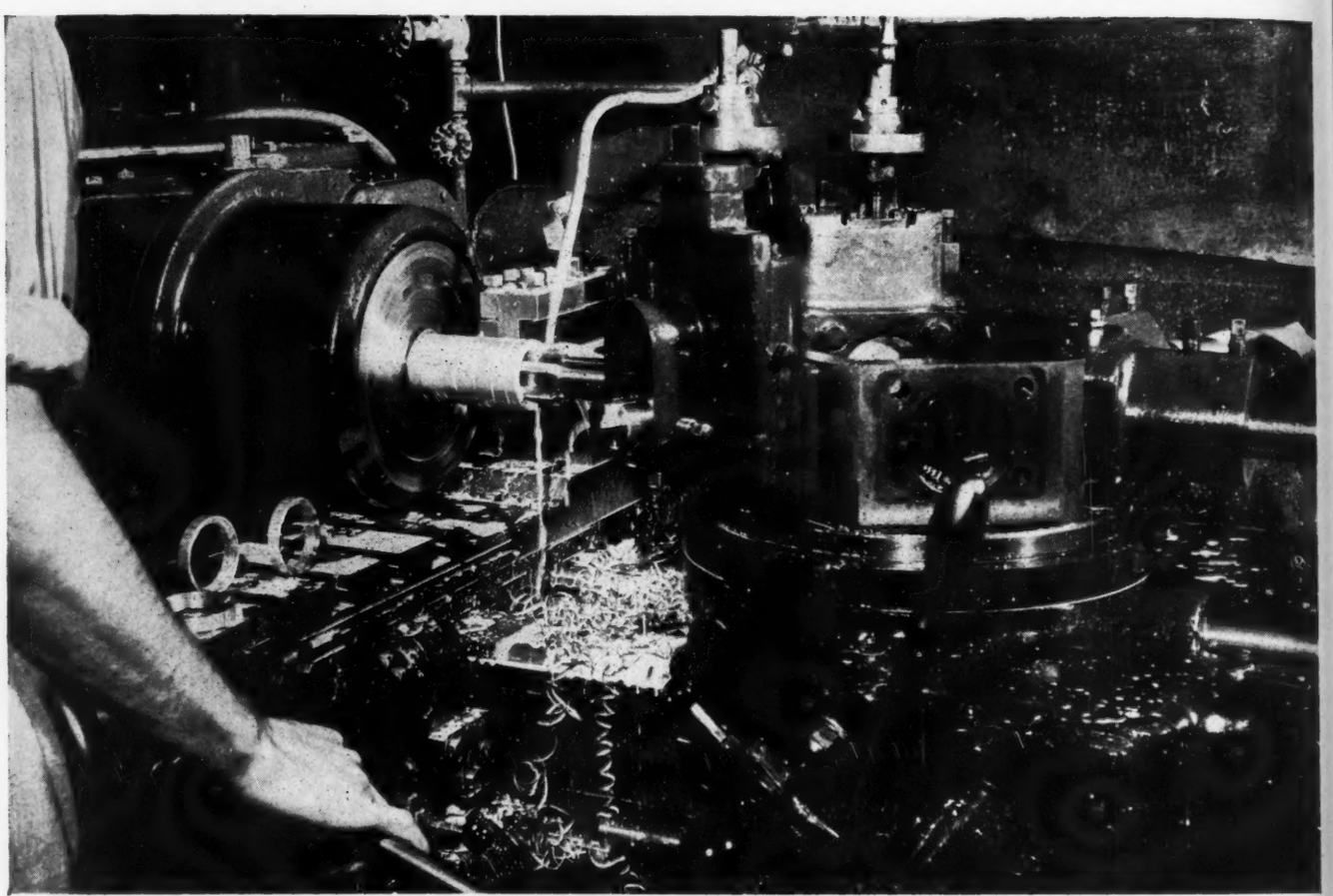
The Baldwin Locomotive Works, Phila. 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, St. Louis, Washington, Boston, San Francisco, Cleveland, Detroit, Pittsburgh, Houston, Birmingham, Norfolk.

BLW
THE BALDWIN GROUP

BALDWIN

FERROUS AND NON-FERROUS CASTINGS

A COOLANT
That LUBRICATES the Tool
SINCLAIR UMBRA



MANY METAL working problems that seem difficult of solution may be the result of using an oil that functions *only as a coolant.*

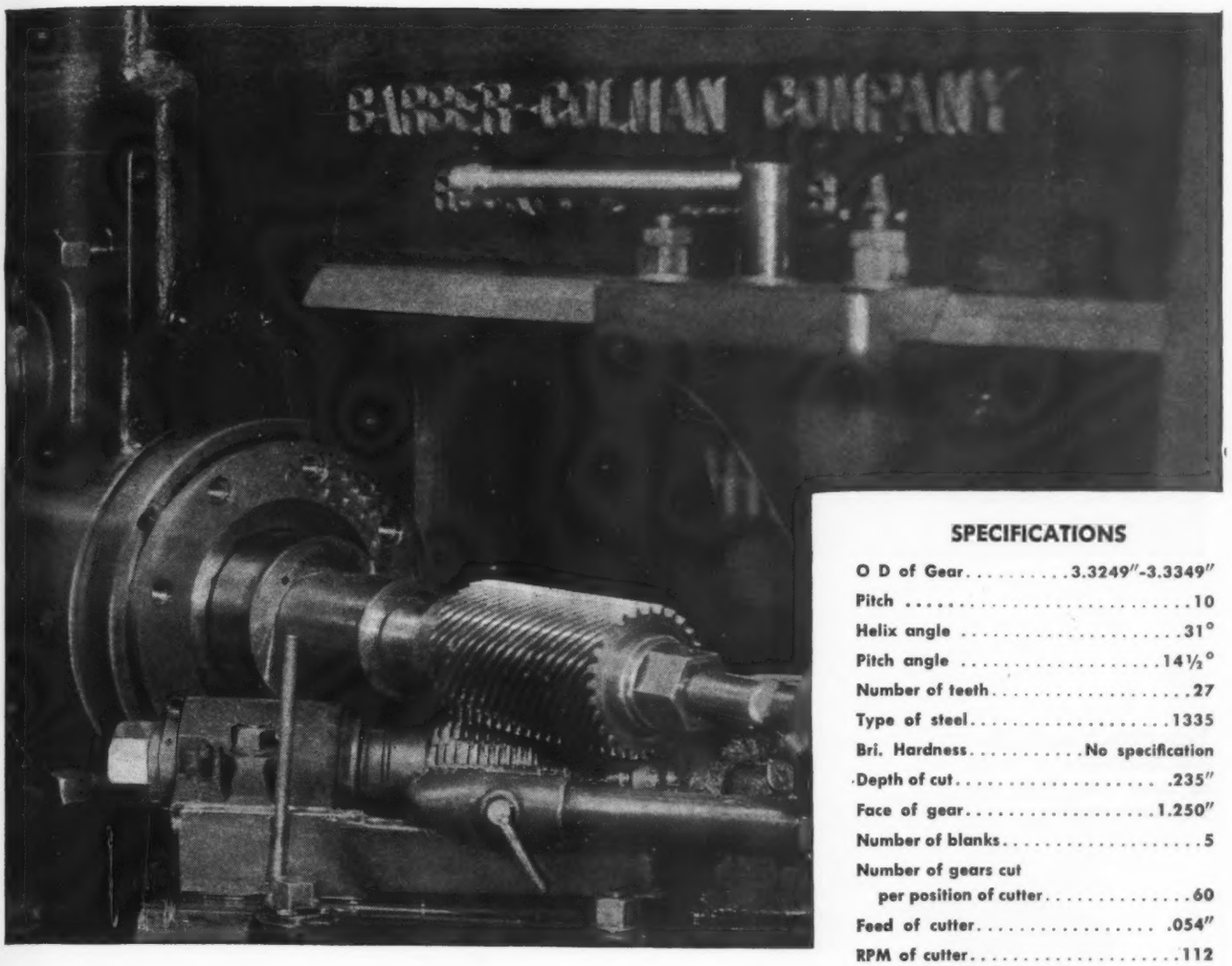
In such cases the answer may be found in a coolant that also has lubricity combined with high anti-weld property. That's where Sinclair UMBRA comes in.

UMBRA is a cutting oil compounded to give it lubricating properties as well as unusual effectiveness as a heat dispersant.

UMBRA is just one of a complete line of Sinclair cutting oils and coolants — a line that provides specialized products for all types of machining.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.



SPECIFICATIONS

O D of Gear	3.3249″-3.3349″
Pitch	10
Helix angle	31°
Pitch angle	14½°
Number of teeth	27
Type of steel	1335
Brl. Hardness	No specification
Depth of cut	.235″
Face of gear	1.250″
Number of blanks	5
Number of gears cut per position of cutter	60
Feed of cutter	.054″
RPM of cutter	112
RPM of work	6
Machine	Barber-Colman Hobber Type A
Amount of metal removed in sharpening CUTTER using Texaco is only	.012″-.015″
Amount of metal necessary to remove in sharpening CUTTER using previous oil	.025″-.030″

100% Longer Hob Life

IN CUTTING gears to the specifications listed above, the operator reported *50% less metal had to be removed from the hob in regrinding — 100% longer hob life* — after he had switched to Texaco! This performance is typical of the greatly improved results you get — in all types of metal cutting — with *Texaco Cutting and Soluble Oils.*

Texaco Cutting and Soluble Oils effectively lubricate and cool tools, prevent chip welding, permit higher cutting speeds, give you more cuts per tool grind and longer tool life. There is a complete line of these outstanding oils to meet every machining requirement — to assure greater output, finer finish, fewer rejects, lower costs.

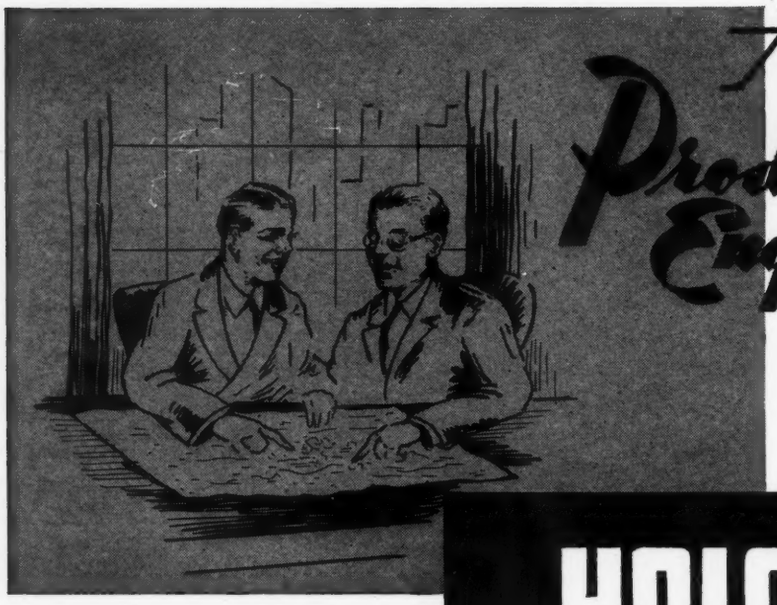
For Texaco Products and Lubrication Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT—CBS



Alert Production Engineers Save Time & Labor

HOLO-KROME

fibro forged

INTERNAL SOCKET SET SCREWS WRENCHING

THE BETTER FASTENING METHOD

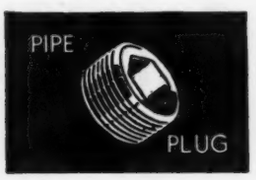
Your Holo-Krome Industrial Distributor is ready to serve you from his warehouse stock.

TIME - because the Internal Wrenching feature permits increased speed in assembly. **LABOR** - because the Internal Wrenching principle assures the same positive tightening in hard-to-get-at locations as in the accessible spots.

The Sockets of these Completely Cold Forged Screws are uniformly accurate to their full depth - true hex shape - smooth regular walls - sharply defined corners - snug fit for the Key - evenly distributed leverage for positive set-ups assured.

ensuring Unfailing PERFORMANCE

THE HOLO-KROME SCREW CORP. HARTFORD 10, CONN., U. S. A.



ALL THE FLUID POWER You Can Use

Here's dependable hydraulic power. Smooth. *Shockless.* Practically limitless. A single Elmes Pump-Accumulator System will operate *any* number of presses at top capacity, three shifts a day.

Pistonless accumulator design eliminates line shocks for longer life of presses, piping, packing, valves, and dies. Elmes accumulators are ballasted by compressed air—have no *dead weight* which must be brought to an abrupt stop when flow is shut off—have no *internal* moving parts whatever; no ram; no packings . . . no leakage!

Patented Elmes controls work automatically to maintain high and low liquid limits within the vessel —*prevent* excessive withdrawal.

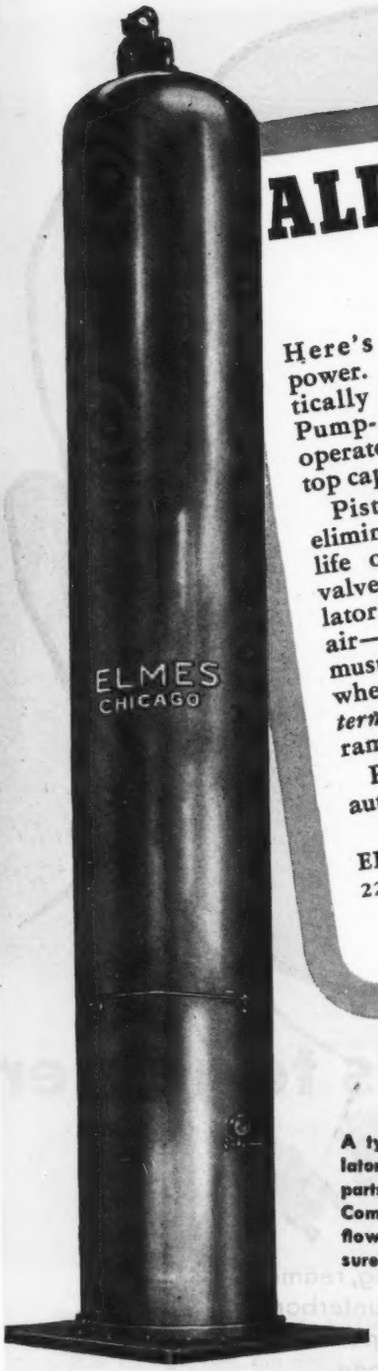
During periods of greatest demand, pump output to presses is augmented from the accumulator supply. As demand slackens, excess pump capacity recharges the accumulator. And when the upper liquid level is reached, the pump is bypassed. Throughout this entire cycle, the accumulator acts to *cushion* fluid flow.

The Elmes Pump-Accumulator System is a scientifically engineered combination of Elmes Accumulators, Elmes Patented Controls, and Elmes High-Pressure Pumps. We'll be glad to give you all the facts.

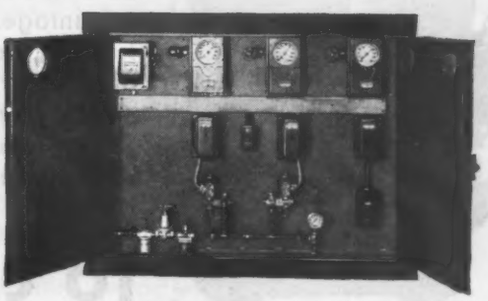
ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES
222 N. Morgan St., Chicago 7, Ill.

Distributors from Coast to Coast

ELMES
Since 1851
HYDRAULIC EQUIPMENT



A typical Elmes pistonless-type accumulator. Has no packings; no internal moving parts. Can be set on usual factory floor. Compressed air ballasting assures uniform flow without line shocks; gives close pressure regulation. All pressures and volumes.



Cabinet-mounted electric control panel. Located wherever convenient near pressure vessel. Can include recording liquid level gauges on large installations.

Elmes six-plunger horizontal pump for 150 to 500 h.p. requirements, and pressures up to 35,000 p.s.i. Smaller pumps are vertical type. All embody every refinement of design and construction.

Send for
Accumulator Bulletin No. 5100 and High-Pressure Pump Bulletin No. 1020.

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

We put our heads together

. . . on every Fleximatic* to combine machining operations to best advantage. Such varied operations as drilling, reaming, tapping, hollow milling, spotfacing and counterboring are performed automatically while the operator removes a finished piece and inserts a new one.

Send us samples and prints of your jobs in this range. We will be glad to study them and show you what a Kingsbury Fleximatic can do . . .

to cut your drilling costs

KINGSBURY

KINGSBURY
MACHINE TOOL CORP.
KEENE, NEW HAMPSHIRE

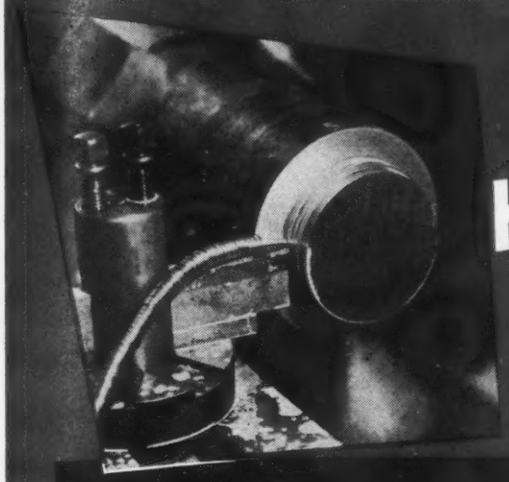
Write for Bulletin E

* **KINGSBURY FLEXIMATIC**

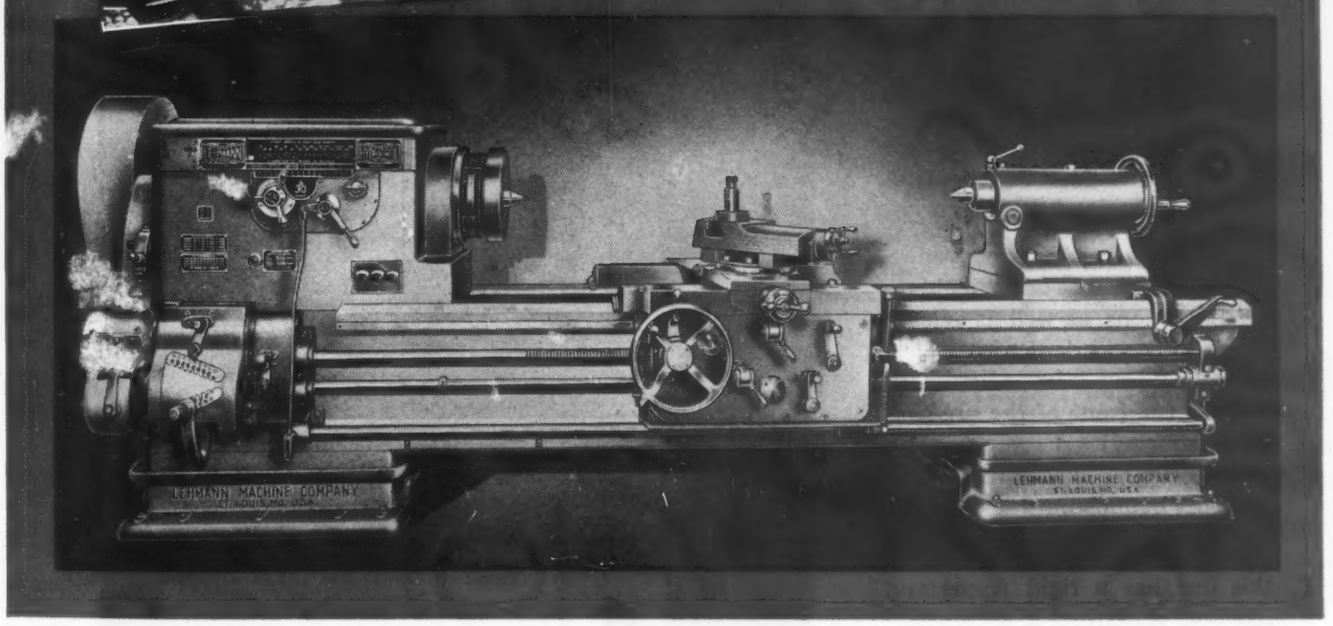
— a special purpose machine for combined automatic operations during a single chucking —the result of Kingsbury engineering ability in the use of low cost standard Kingsbury drilling and tapping heads on standard Kingsbury bases.

HYDRATROL LATHES

Keep Right On Cutting



. . . CUTTING COSTS
. . . CUTTING TIME
. . . CUTTING REJECTS!



WHEN HYDRATROL LATHES enter the machine tool picture, the story is invariably one of Lower Costs, Increased Production, and Improved Work.

Shop after shop is finding that it can do many machining jobs *better* with a Heavy Duty HYDRATROL LATHE. The 30" size, shown above, has all the ruggedness and power for the heaviest possible work. And its many refinements in design and construction result in an ease of operation comparable to small machines.

Why not let us show you what a Heavy Duty HYDRATROL LATHE could do in *your* shop? Send us prints for a time-and-money saving recommendation.

Standard Type, Heavy Duty Lathes, 20" to 36"
Large Hollow Spindle Type Lathes, 18" to 36"

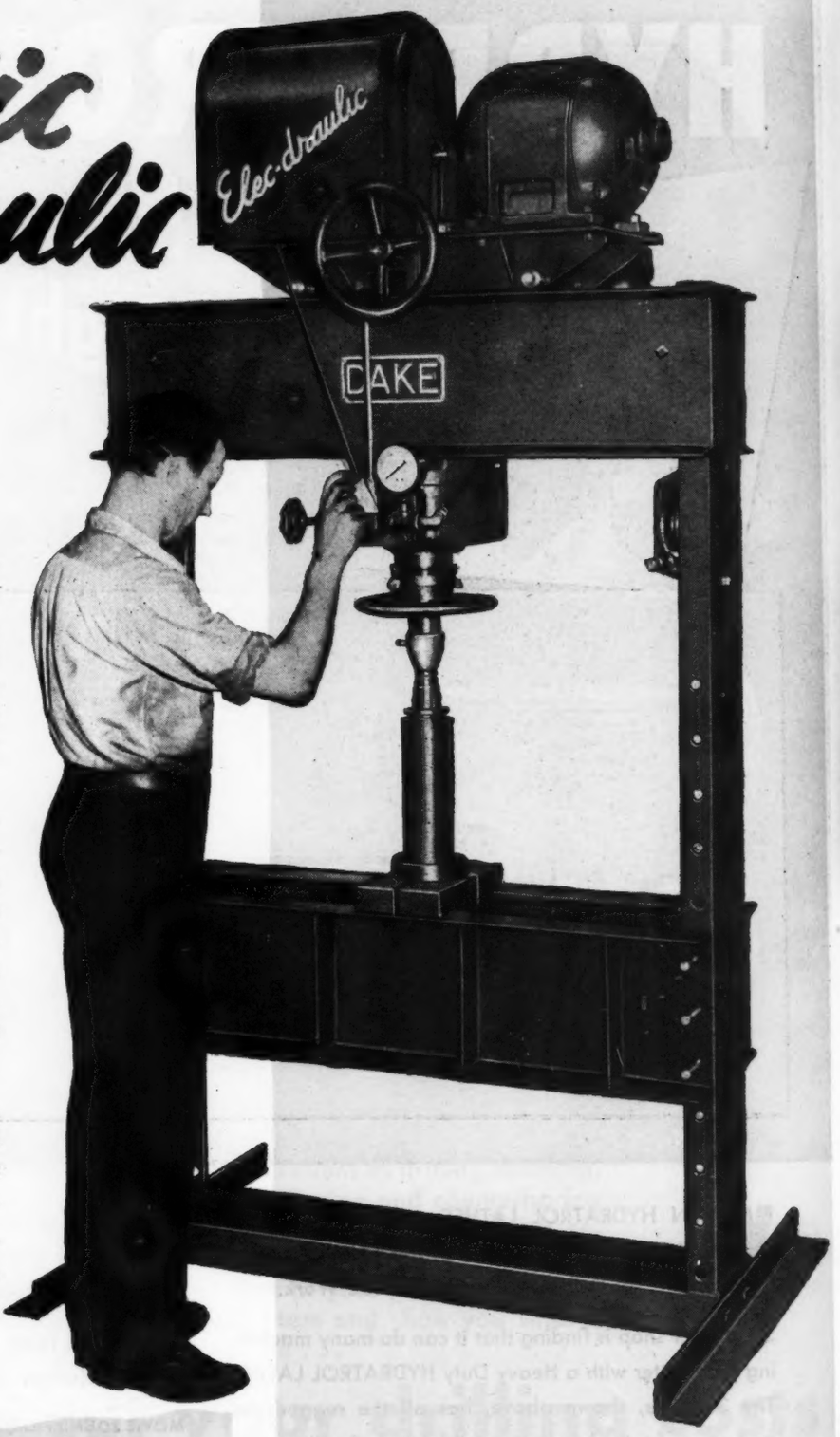
MOVIE SOUND FILM, in natural color, available, showing functions of Hydratrol Lathe, advanced construction features, and production machines in operation. Ask the Lehmann representative for a showing.

LEHMANN MACHINE COMPANY, ST. LOUIS 3, MISSOURI

HYDRATROL LATHES
(HEAVY DUTY TYPE)

Elec-Tric Hydraulic PRESS

—fingertip control
—no hand pumping



Now you can get a press that *completely eliminates hand-pumping*. The new Dake Elec-draulic Press provides up to 75 tons from a motor-driven pressure source. And any pressure can be repeated, held, or changed—without stopping the motor.

This press is ideal for production, assembling, and straightening operations, as well as general maintenance work. Pressures are set or released from simple controls at the front of the press. A gauge at eye level speeds operation, and a special safety valve prevents overload.

Like all Dake hydraulic presses, this one has a rigid frame and movable workhead. It is available in either a 50- or 75-ton capacity.

For information about this or the smaller presses which make up the complete Dake line, mail the coupon below.

● Dake Engine Company
604 Seventh St., Grand Haven, Mich.

Please mail me a copy of the latest Dake Arbor Press Catalog.

Name_____ Title_____

Company_____

Address_____

DAKE
ENGINE COMPANY
GRAND HAVEN, MICHIGAN

AJAX

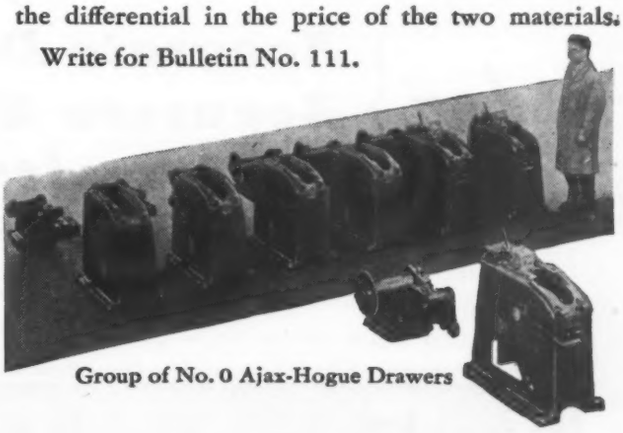
Hogue Wire Drawer

An Attachment which Improves the Quality and Lowers the Cost of Cold Heading

This attachment for any make of Cold Header lowers production costs and improves the quality and accuracy of the finished products. By providing freshly drawn and coated, clean, straight, accurate wire for the header dies, a high degree of uniformity is attained. The lower yield point of the freshly drawn wire allows the metal to flow more freely, filling out the die impressions. This makes heading easier, with considerably less wear on the dies.

The Ajax-Hogue Drawers are built in five sizes for wire diameters of ¼ to ¾ inch. Hot rolled stock is used instead of cold drawn wire, with the saving of the differential in the price of the two materials.

Write for Bulletin No. 111.



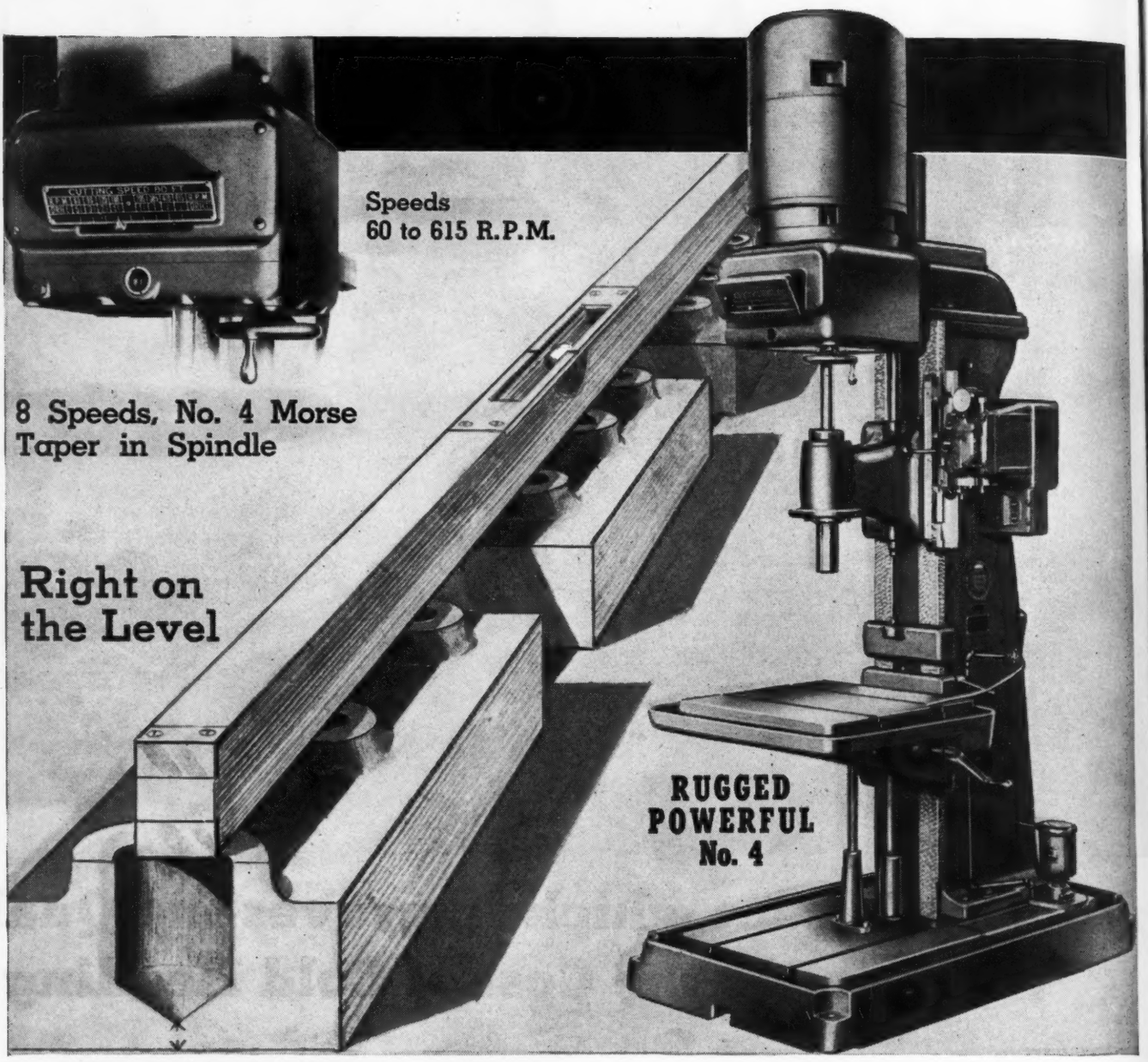
Group of No. 0 Ajax-Hogue Drawers

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST. • CHICAGO 3, ILLINOIS

DEWART BUILDING • NEW LONDON, CONN.



LELAND-GIFFORD Hydraulic Drilling Machine

for ***Accurate Depths*** in Counterboring
Accurate Heights in Spot Facing
Uniformity from piece to piece

assured by the positive but easily adjustable metal to metal depth stop.

LELAND-GIFFORD

WORCESTER 1 MASSACHUSETTS U. S. A.

105 TONS

of Precision Boring Machine

This 4-spindle INGERSOLL Machine bores the sleeve holes in welded steel Diesel Engine frames to limits of .001".

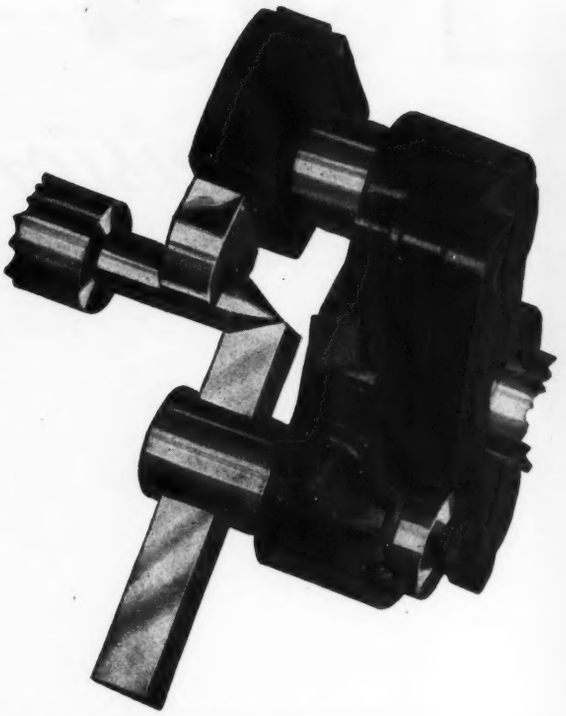
INGERSOLL assumed the responsibility for the entire installation, including the fixtures and tools . . . and produced to a predetermined production rate and accuracy guarantee.

We will gladly discuss your needs with you.

INGERSOLL

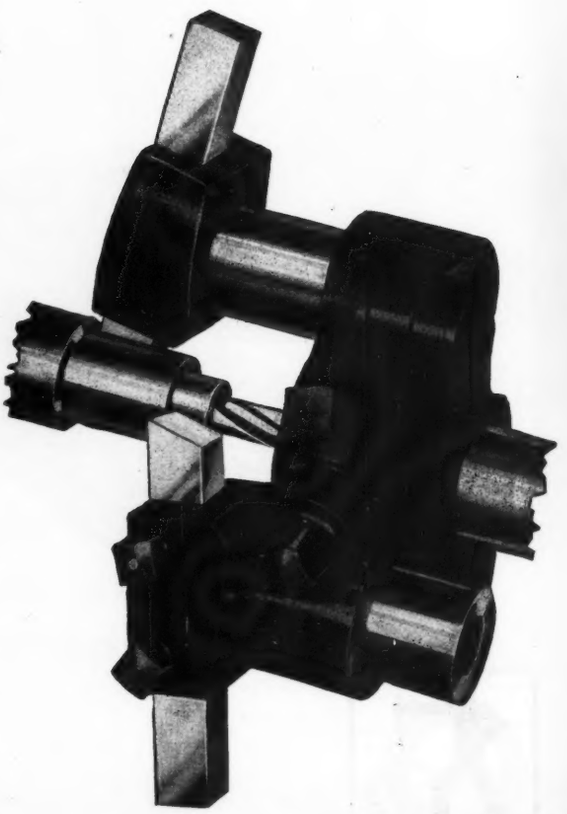
THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

UP PRODUCTION!



DOWN COSTS!

Send production UP . . . yet keep costs down where they belong . . . by using R and L Turning Tools! Built in five convenient sizes, they can be quickly set up for right- or left-hand operation on your turret lathes and screw machines to perform combinations of two or more operations at one work station. Boring, drilling, reaming, facing, burnishing, chamfering, centering can be done over a wide range of work, and because of the R and L multiple-operation feature, a high degree of concentricity is assured . . . in addition to worthwhile time-savings, machine-savings and tool-savings. If you are looking for practical ways to increase the production capacity of your machines, choose the R and L way of adding "extra spindles" by doubling up on operations. Send for your copy of the R and L Booklet. It gives complete details of R and L Turning Tools, and illustrates many of its unique tooling possibilities.



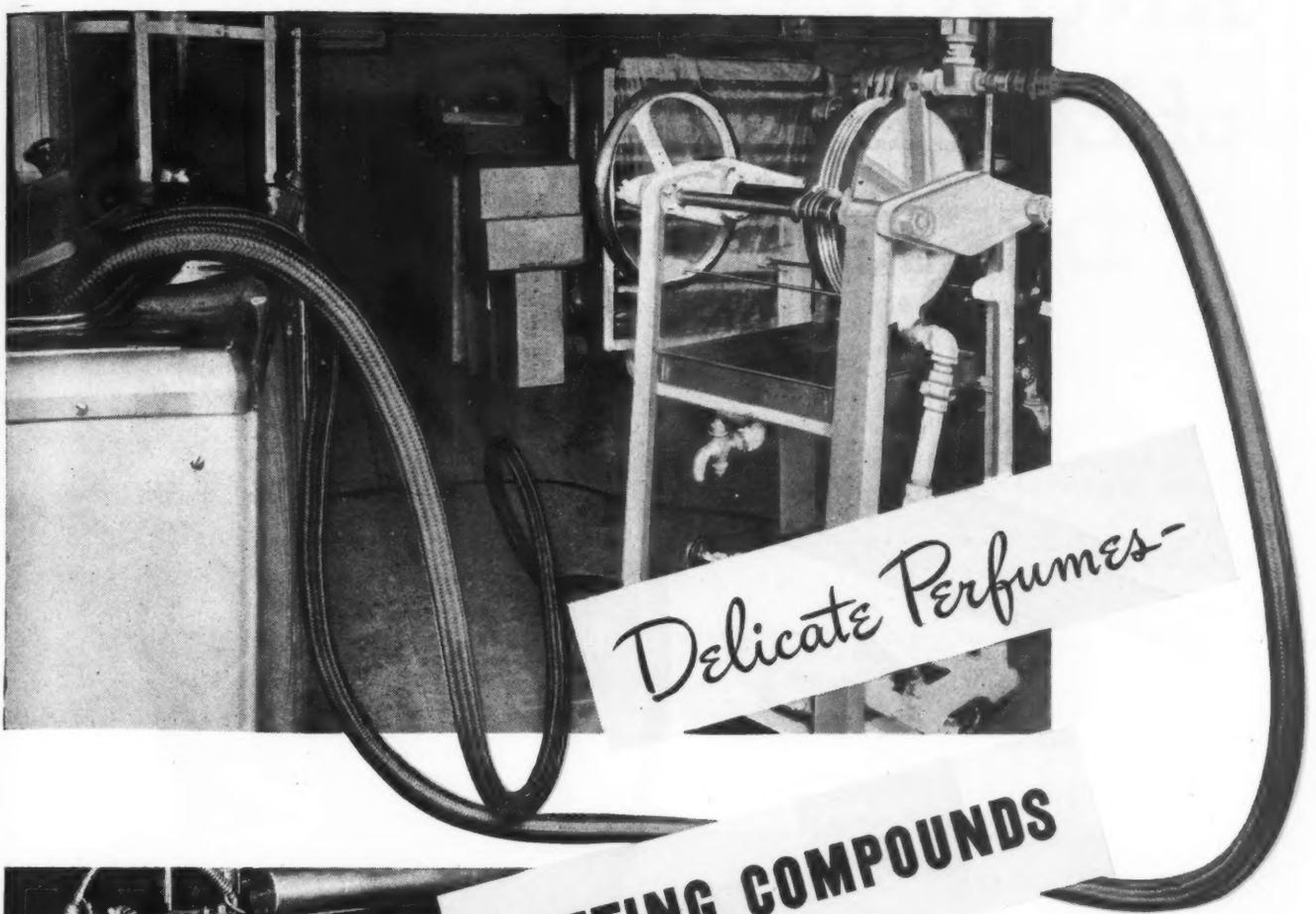
These typical set-ups show how R and L Turning Tools cut tooling time, speed operations and increase production capacity. Upper left: Turning and forming special shape on end of part while drilling or reaming. Upper right: Pointing work concentric with turned diameter using burnishing backrest to support work. Above: Turning two diameters while drilling or reaming.

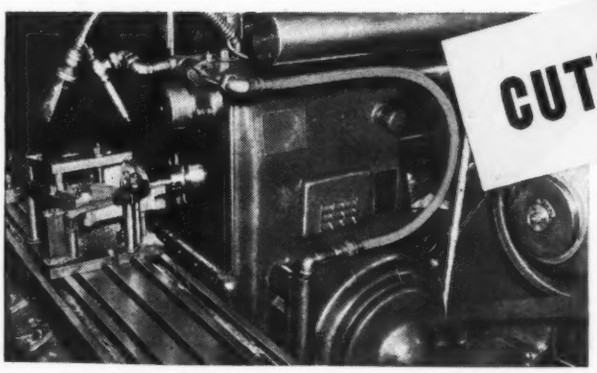
R AND L TOOLS

1825 BRISTOL STREET

NICETOWN — PHILADELPHIA, PA.

• *The readily-maintained cleanliness of American Seamless assures this user complete freedom from impurities that might contaminate delicate perfume being carried between storage tank and filter.*





• *American Seamless is standard equipment on this make of milling machine. Used for carrying oils, solvents and cutting compounds, its sturdy toughness assures long, economical service.*

BOTH conveyed through *Flexible* Connections

THESE ILLUSTRATIONS show but two of thousands of various applications of American Flexible Metal Hose and Seamless Flexible Tubing. For these durable products are continually being adapted to new and "different" engineering needs.

Steam, oil, water, gases, refrigerants and other fluids ... at high or low pressures and temperatures ... are safely and economically handled by American assemblies.

Whether *your* problem is one of compensating for vibration, connecting moving parts, or providing for misalignment, American has ... or can quickly develop ... a flexible assembly to do the job.

For detailed information on American Flexible Metal Hose and Seamless Tubing, write for Publication SS-50.

46360

ANACONDA

American

METAL HOSE

THE AMERICAN BRASS COMPANY

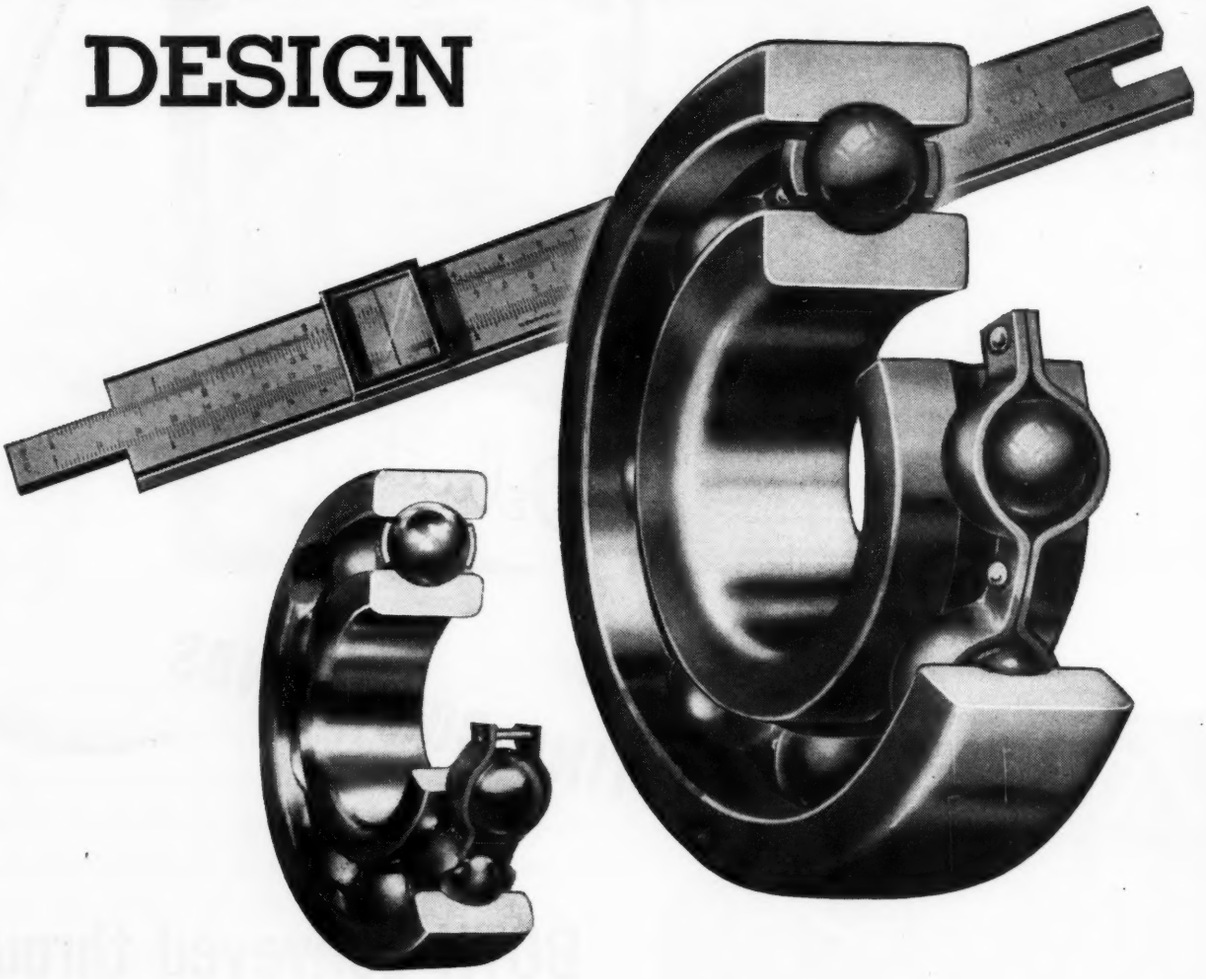
American Metal Hose Branch

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

"KNOWN FACTORS" of EQUIPMENT DESIGN



BCA BALL BEARINGS have dependably served American industrial leaders for nearly 50 years. When BCA's are specified, the bearings on your equipment are known factors. Each type can be relied upon to meet specified conditions of shock, load and thrust. BCA engineering is precise . . . BCA construction is rugged . . . BCA inspection is thorough. You're sure of dependable performance with BCA's . . . one of America's *proved* ball bearings.

BCA

BEARINGS COMPANY OF AMERICA • LANCASTER, PA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

The CONE AUTOMATIC MACHINE COMPANY
sees many
GOOD THINGS AHEAD

It is reported that . . . . . .

The Railroad Research Bureau of U. S. Steel Corporation has designed an all-welded steel coal car that eliminates 15% of dead weight.

get ready with CONE for tomorrow

B. F. Goodrich announces a new "white carbon black" which will permit the making of white and colored tires.

get ready with CONE for tomorrow

A new oven developed by Vendo Company of Kansas City cooks with steam pressure.

get ready with CONE for tomorrow

"Sinsteel G," developed by American Electro Metal Company, is a duplex metal made by impregnating porous, sintered steel with copper. Because of its copper content, it can be brazed.

get ready with CONE for tomorrow

Lockheed Aircraft Corporation is testing its "Speedpak," a streamlined metal container that fastens to the underside of an airliner and holds four tons of cargo.

get ready with CONE for tomorrow

Westinghouse has patents on a new fluorescent lamp that resembles an incandescent bulb and uses arsenic in place of mercury.

get ready with CONE for tomorrow

Du Pont is developing a method of porcelain enameling aluminum.

get ready with CONE for tomorrow

A 2-horsepower electric motor, weighing only fifteen pounds, is made by Electrical Engineering & Manufacturing Corporation.

Myles Plastics Corporation of New York claims to have methods and compounds by which small, simple plastic parts can be molded cold at rates of 25,000 per hour or better.

get ready with CONE for tomorrow

Chestnut trees, the chief source of leather tanning agents, are threatened by blight, but Monsanto chemists are working on a synthetic tan to take its place.

get ready with CONE for tomorrow

The new semi-automatic machines of General Tire and Rubber Company can turn out a tire every two minutes, which is about twice the usual output.

A vacuum-draft oil burning furnace that does not require the conventional type of chimney was shown by the Norge Division of Borg-Warner Corporation at the Oil Heat Exposition.

get ready with CONE for tomorrow

Cranberry Canners Inc. of Cape Cod will test a mechanical cranberry picker this fall. It is expected to increase the yield per acre and double the rate of harvesting.

get ready with CONE for tomorrow

The United States Patent Office is sorting and evaluating 10 tons of Nazi patents brought here from Germany.

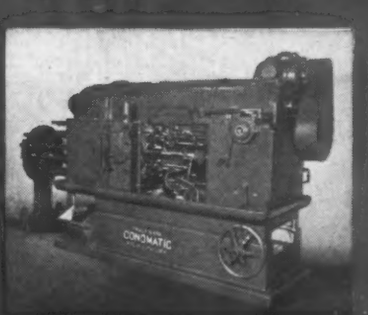
get ready with CONE for tomorrow

Great deposits of bauxite have been located in Oregon, conveniently near the hydroelectric plants of the Pacific Northwest, by the Oregon State Department of Geology and Mineral Resources.

Another good TURN

for You

This 9½" wrench handle is made of SAE 4130 ⅝" round stock. Twelve operations are completed within the tolerances specified in 55 seconds. The Conomatic, an innovation in the 8-spindle field, has led in the handling of work hitherto thought impractical including pieces up to 25 ⅝" in length.



Ask your CONE *representative to show you our new color motion picture*

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

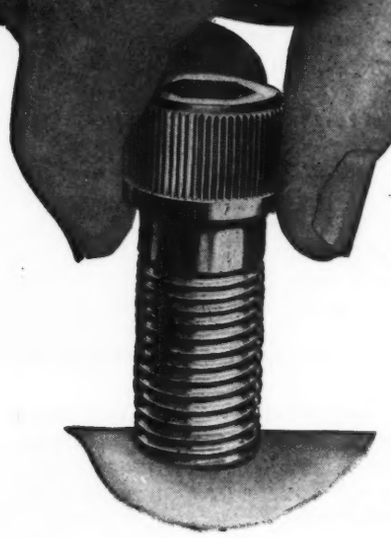
...The Knurled Heads

SAVE TIME.

KNURLED

UNBRAKO

Reg. U. S. Pat. Off.



SOCKET HEAD CAP SCREW

Yes, the knurled head of the "Unbrako" Socket Head Cap Screw makes it a time- and money-saver, because the knurls provide a slip- and fumble-proof grip, even for oily fingers. Thus it can be screwed-in faster and farther before it becomes necessary to use a wrench. Of outstandingly good quality, it is neat and attractive, too—helps make any machine look better.

Pat. & Pats. Pend.

Socket Set-Screws are furnished with 5 different styles of points. Of these the Cup-point (left) is the only one which, when knurled, converts its screw into a Self-Locker. The knurled point digs-in and refuses to budge . . . regardless of the most chattering vibration! Yet, this screw can easily be backed-out with a wrench and used again and again. However, the "Unbrako" Socket Set Screw with Knurled Threads (right), is also a Self-Locker, regardless of the style of point. It can, therefore, be used where the "Unbrako" Cup-Pointed Self-Locker would be unsuitable.

All screws in sizes from No. 4 to 1½"; write for the "Unbrako" Catalog of Socket Screw products.

Pat. & Pats. Pend.

"Unbrako" and "Hallowell" products are sold entirely through distributors.

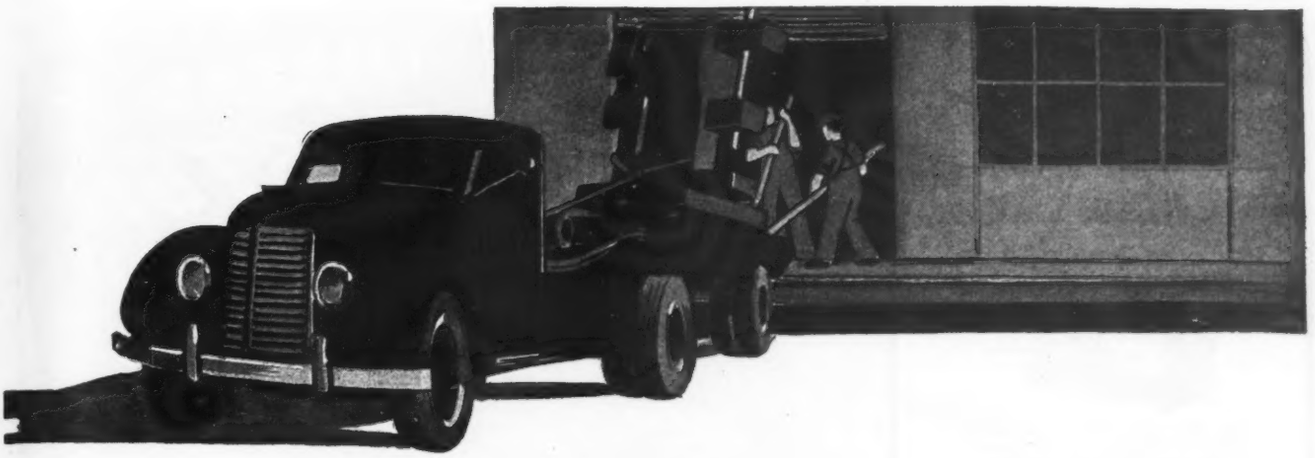
Knurling of Socket Screws originated with "Unbrako" in 1934.

ARMY E NAVY

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO



WHEN IS A MACHINE *"Washed Up"?*

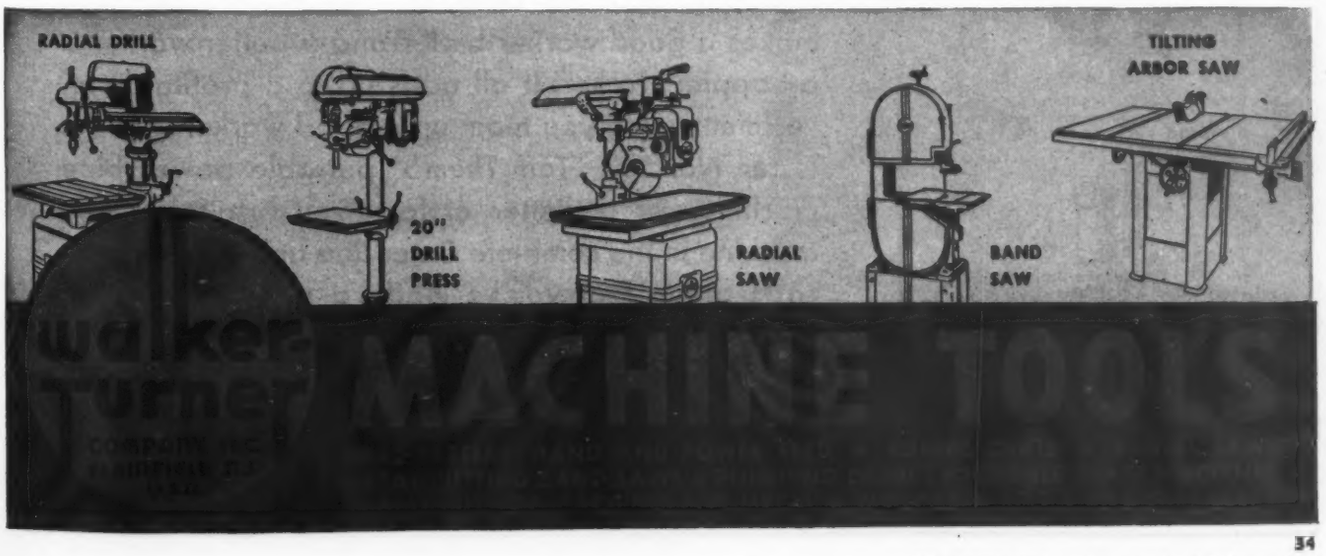
In seven years some say—but in modern production practice it is not a question of years or how much the machine has earned or still owes you. The question is, will your equipment enable you to compete with the new, faster working, more efficient and flexible layouts in your competitors' plants.

A five-year-old Machine Tool is "washed up", for instance, if it can be replaced by one costing a few hundred dollars that will write itself off in less than a year through improved production. That's the story of Walker-Turner Machine Tools wherever metals, wood or plastics are drilled, cut or shaped.

These machines are "light" only in weight and price. Their production output in the past eight years has astounded the management of thousands of plants—large and small—throughout the country.

A key to high manufacturing efficiency and **low manufacturing costs** is the modern, flexible, light machine tool. It represents small capital investment, flexibility of operation, increased productivity and low operating costs.

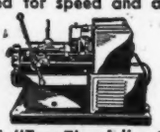
Walker-Turner Machine Tools are sold only by authorized Industrial Machinery Distributors. A general catalog will be sent on request.



No. 422 *"Power Vise Stand"* converts hand tools to power tools for threading, cutting, reaming pipe.

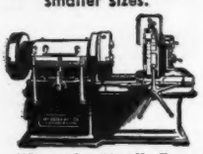
No. 502 *"Pipe Master,"* the lowest priced complete, portable power pipe machine on the market.

No. 562 *"Tom Thumb,"* another Oster portable power pipe machine designed for speed and accuracy.



No. 531 *"Tom Thumb,"* rotary die-head type designed for threading bolts, rods, studs, pipe, nipples, etc.

No. 572 *"Rapiduction Junior"* . . . floor type power pipe machine for production threading of the smaller sizes.



Oster *"Rapiduction"* floor-type, high speed, high production threading machines. Made in three sizes.

Oster *"Wilco" power threading machines* designed for maintenance and production threading. Two sizes.

Oster *No. 300 Series* general purpose threading machines with revolving die-head and open type vise. Three sizes.

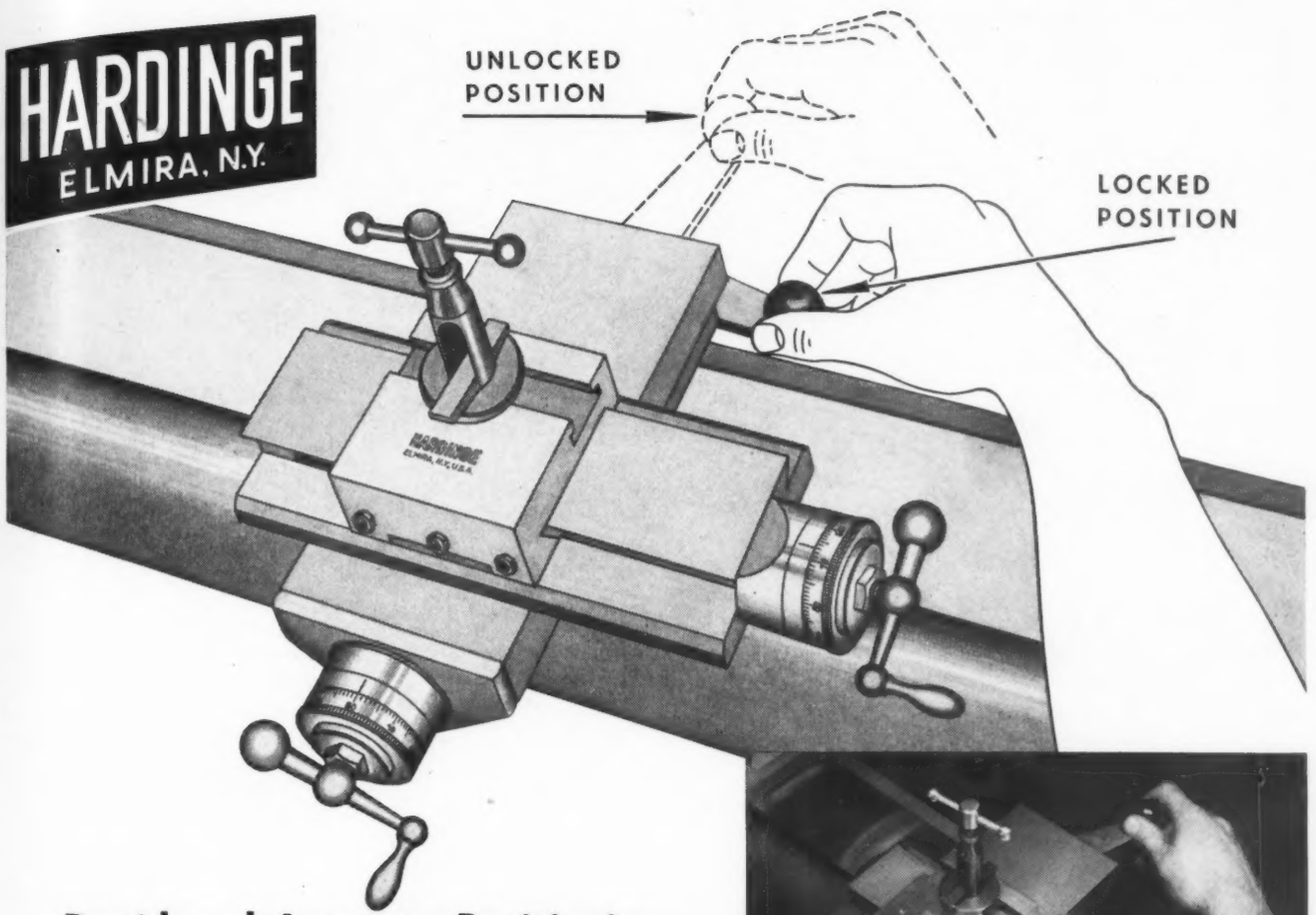
No. 542 *"Rapiduction Junior"* with revolving die-head and open type vise. Handles wide variety of threading work.

All operators of the Oster No. 562 *"Tom Thumb"* don't whistle while they work. Some men prefer to hum or chuckle. Others just smile. The point is that threading pipe or bolts on this modern machine makes a good worker better and a better worker is a happier worker. It all adds up to a profitable investment when you team up a good worker with the Oster No. 562 *"Tom Thumb"* portable power pipe machine. As a matter of fact, you can select any machine in the complete Oster line and let your own costs prove that you've made a good investment.

OSTER ***machines make jobs***

THE OSTER MANUFACTURING COMPANY, 2073 EAST 61st ST., CLEVELAND 3, OHIO, U. S. A.

HARDINGE
ELMIRA, N.Y.

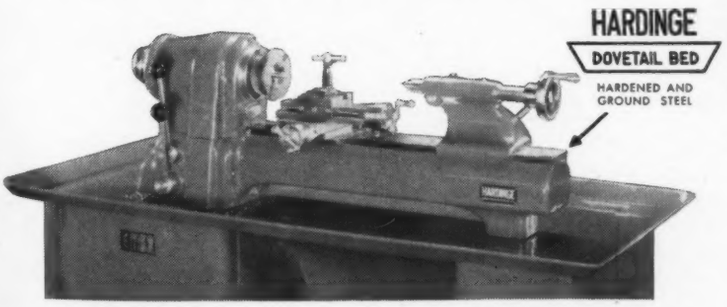


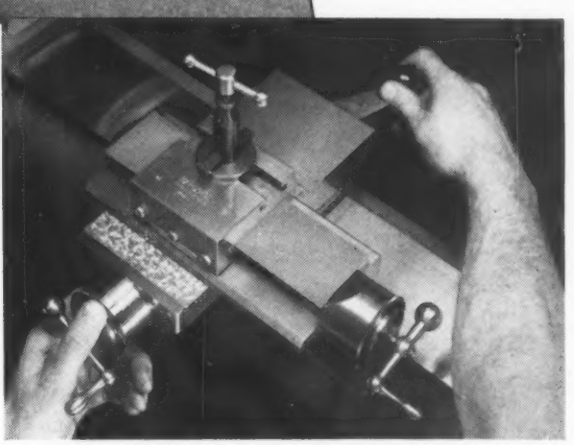
Rapid and Accurate Positioning with HARDINGE Compound Slide Rest

This compound slide rest obsoletes all other compound slide rests due to speed and accuracy of operation. It can be applied or removed from the HARDINGE Dovetail Bed in five seconds or less, making it the fastest positioning compound slide rest known. Also, when removed from the dovetail bed and reapplied, it will repeat previous index slide settings in relation to the spindle centerline. This cannot be said for ordinary compound slide rests.

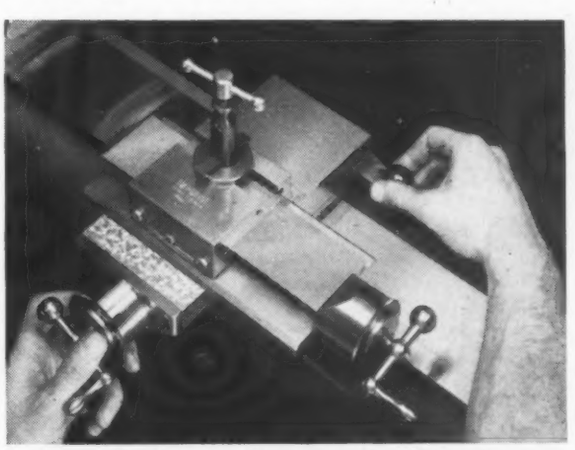
OTHER FEATURES: Hardened and ground steel index slide section; large hardened feed screws mounted on preloaded ball bearings; easy-to-read 2″ diameter feed screw dials; index slide swivels 360° and has two independent locks; solid bottom slide does not have a weakening T-slot for conventional bed bolts.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.



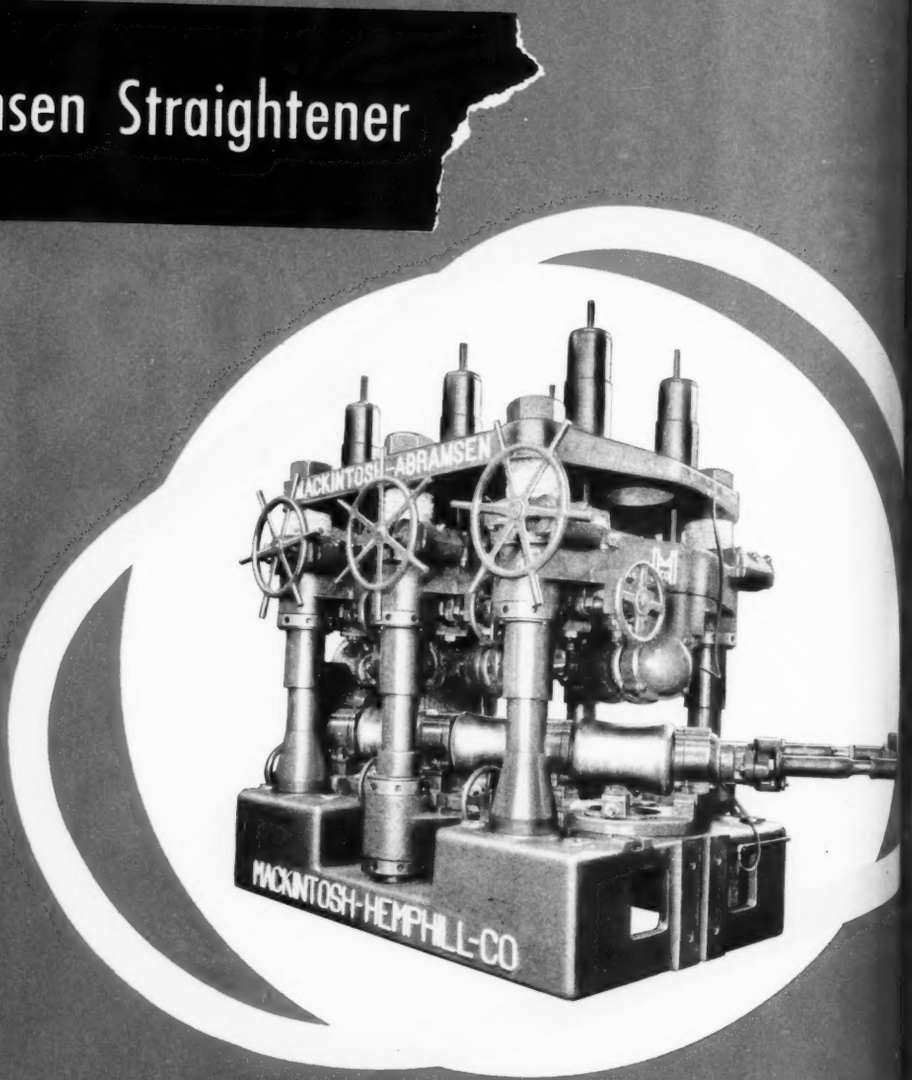


In the unlocked position, the quick-acting lock is released, permitting the Hardinge Compound Slide Rest to be moved along the bed ways or lifted from the machine.



The Hardinge Compound Slide Rest is rapidly and accurately locked in any desired position on the bed ways by a simple 90° movement of the lever.

The Mackintosh-Abramsen Straightener

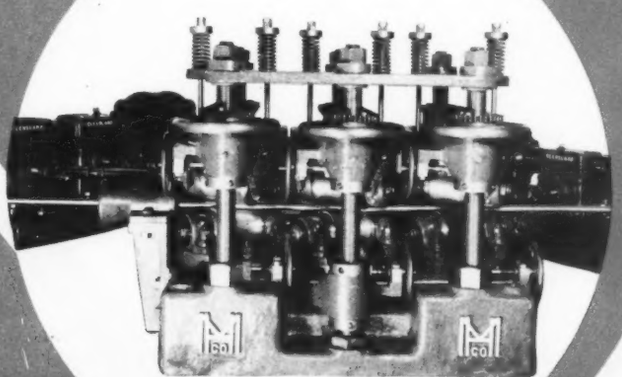


cuts setting-up operations

In these improved Mackintosh-Abramsen straighteners guides have been eliminated, preventing ringing and scoring of stock. Stock action and exact quality of finish are controlled by three pairs of rolls . . . the outer pairs fixed and the inner pair offset, utilizing a balanced arrangement of drives. The bending action on stock is continuous, from section to section rather than point to point, eliminating end bends. Thus distributing the cold work uniformly over the entire length of the bar or pipe. Design has been so simplified that adjustments and roll changes are much easier to make.

Here is a straightener that will speed up production, cut operating costs, and deliver an absolutely straight product—from end to end. Just another example of Mackintosh-Hemphill's advanced industrial thinking.

Mackintosh-Abramsen straighteners are made to handle ferrous or non-ferrous tubing from 1/16" to 24" diameters and bars from 1/8" to 8 1/2" diameter.



sin half

Mackintosh-Hemphill Company

PITTSBURGH AND MIDLAND, PENNSYLVANIA

Makers of the Rolls with the Red Wabblers

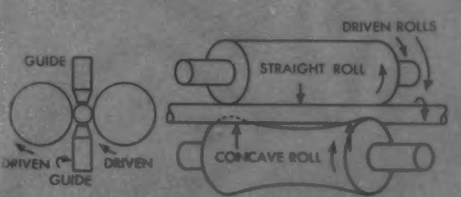
It will

- √ Reduce setting-up operations from 31 to 16
- √ Give you a straighter product—hot or cold
- √ Give you a smoother, cleaner product
- √ Increase production rates
- √ Remove out-of-roundness
- √ Lower production costs
- √ Remove end bends

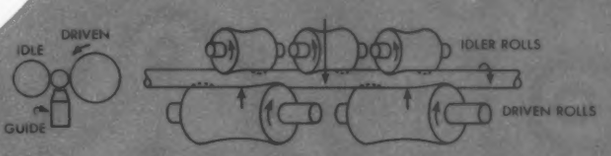
It won't

- X Spiral-mark thin wall tubes or soft material
- X Destroy the surface on coated materials
- X Guide-score finished material
- X Unduly harden ductile metals

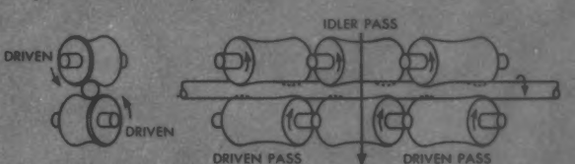
Here's why:



One current method of straightening is done in one set of cross rolls. Guides are used to hold material on the pass line. The straightening takes place from point to point on the rolls and against the guides. Efficiency drops with wear on the rolls.



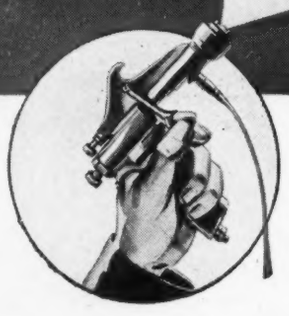
A second current method of straightening is done by a pressure roll between two cross roll passes. Material is held on the pass line by a bottom guide. The straightening takes place from point to point on the rolls and against the guide. Efficiency drops with wear on the rolls.



The Mackintosh-Abramsen method of straightening is accomplished by an offset cross roll pass between two fixed cross roll passes (patented). No guides are required because the rolls are driven on both sides of the material which is supported by the bottom rolls. With this balanced arrangement there is no decreasing efficiency from uneven wearing of the rolls. The straightening takes place from section to section and not from point to point.

NU-SPEDE INTERIOR FINISH

Gives A Hard, Durable and Economical Finish to Consumer Products



Versatile Nu-Spede Interior Finish applies quickly, dries quickly, and covers solidly with one durable coat —fulfilling a wide variety of finishing requirements for consumer goods.

With light reflectional value, *proved over 85%*, Lowe Brothers Nu-Spede Interior Finish gives new brightness to bus interiors and reflectors. It is also ideal finish for heating, ventilating and air conditioning unit housings, metal furniture, bicycles, cabinets, kitchen appliances, refrigerators and countless other products.

This multi-purpose Finish can be made in *all* colors, either semi-gloss or full gloss — to conform to specific finishing requirements.

Taking a reduction of 4 to 1 with Nu-Spede Reducer, the Finish is quickly spray-applied. It flows on smoothly, evenly—then airdries dust-free in only 15 minutes.

Nu-Spede Interior Finish bakes in 15 minutes at 300°—and in just 8 minutes under infrared (optional schedules are available). It bakes to an attractive, hard finish that resists abrasion and will not discolor.

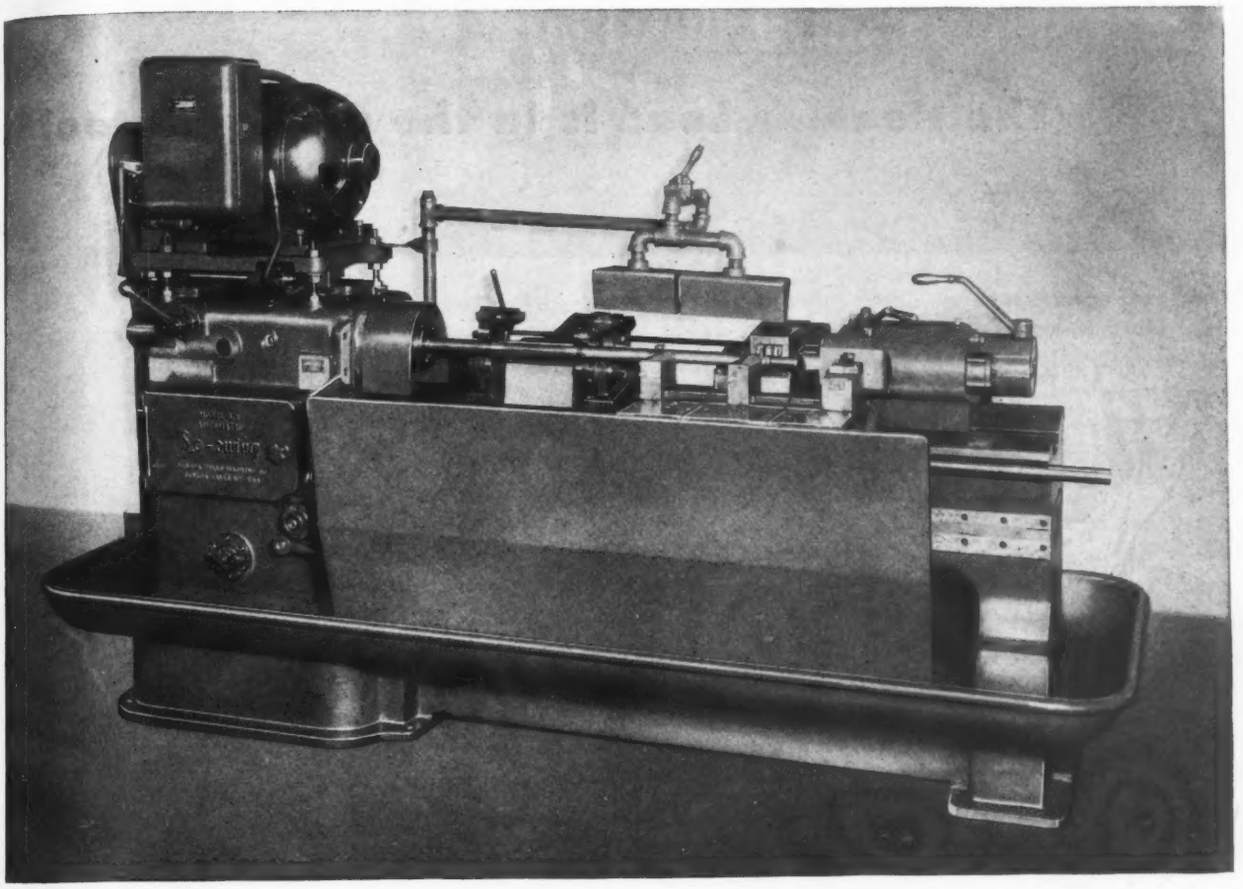
For complete details on the application of production-speeding, economical Nu-Spede Interior Finish to *your* finishing requirements — write now, without obligation, to

INDUSTRIAL SALES
THE LOWE BROTHERS COMPANY
DAYTON, OHIO

Lowe Brothers
FINISHES for Industry

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

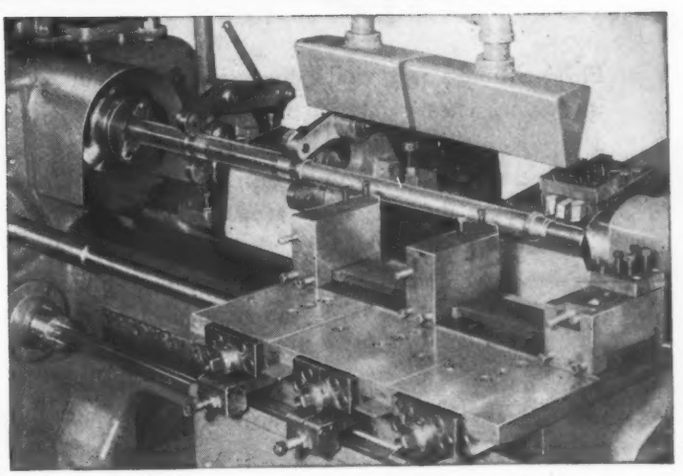


MODEL LR *Lo-swing* LATHE EQUIPPED FOR TURNING LONG, SLENDER SHAFTS

Problem: To provide a fully automatic Lathe capable of turning long, slender tubes with sintered carbide tools.

Solution: In order to reduce the number of tools in contact with the work to a minimum and thus avoid distortion of the tube, this job required a machine with a specially long carriage feed.

A Model LR Lo-swing was selected for this job and equipped with a special longitudinal feed attachment permitting a maximum carriage travel of 9" which was in excess of that required for this job. The tube is held between centers and driven with a Seneca Falls Automatic Driver which assures a positive balanced drive and also prevents distortion. The work is supported with two-roller steady rests, the rolls of which are in contact with two ground spottings. One-half of the shaft is turned as shown in illustration, after which the shaft is reversed and the opposite end turned.



Another feature of this machine is the three slide carriage having independently cam-controlled slides operated through the Seneca Falls SIMPLIFIED CHANGE-OVER MECHANISM. Each slide may be set for different lengths of cuts by a simple adjustment of gear segments which are fitted with graduated scales corresponding to desired length of cut in inches.

The Model LR Lo-swing Lathe is completely automatic; the operator simply loads and unloads the work and pulls the starting handle.

LATHE NEWS from SENECA FALLS

The Heavier Load is in the package, too!

Physical-fitness is a vital "dimension" in a ball bearing when it has a heavy-duty job to do. And it calls for the right degree of resilience, toughness and resistance to compression and distortion...with no sacrifice of precision.

Hardening the race rings *right through to the core* is Federal's way of "building-in" the needed strength to withstand the severe pressure of the ball on the ball track, particularly under heavy load. Automatic electric controls insure a uniform heat-treat throughout the entire Federal hardening cycle, while a percentage of each lot of rings is crush-tested to determine load-bearing strength. The fine grain of the fracture tells the "inside" story in inspection, but more important, adds long life to the bearing on the job.

Conditioning a Federal Ball Bearing for the tougher jobs is but one of over 100 individual production, inspection and cleaning operations that go into a single-row radial bearing. *With every fourth operator an inspector,* you may be sure that Federals are right *wherever tolerances are tight.*

Specify Federal Ball Bearings for the heavy loads—in any range or size.

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, NEW YORK

Makers of Fine Ball Bearings

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
Chicago: 8 S. Michigan Ave.—3 • Los Angeles: 5410 Wilshire Blvd.—36

FEDERAL BALL BEARINGS

ONE OF AMERICA'S LEADING BALL BEARING MANUFACTURERS

Precision cylinder construction

6 x 10 inch cylinder with head end cushion

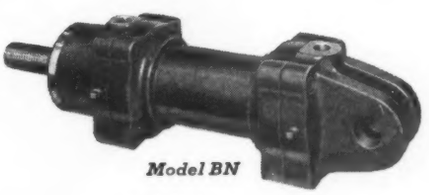
Builders of machine tools, steel mill equipment, heavy duty lift trucks, and many other types of hydraulic actuated equipment find Hannifin precision hydraulic cylinders deliver performance that matches the finest of modern machine design. Hannifin cylinder construction means a simpler and easier installation, efficient use of hydraulic power, and long life without maintenance.

No-tie-rod design provides a strong, simple cylinder, and allows removal of an end cap without collapse of other parts. Either end cap can be positioned independently for simplest piping and mounting.

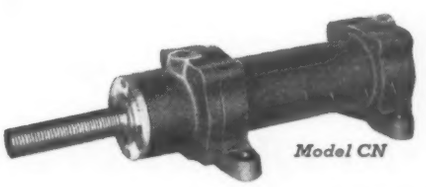
Cylinder bodies are bored and honed to exact size, giving a cylinder interior that is straight, round, perfectly smooth. The use of a piston with precision rings in this accurate cylinder bore provides high efficiency piston seal, maintained throughout a long service life. Exact bores and close tolerance piston with precision rings means minimum fluid slip and maximum useful hydraulic power.

Seven standard mounting types are available in a full range of sizes, 1 to 6 inch bore, with any length stroke. Cylinders can be furnished with or without adjustable cushion, and with small diameter piston rod, 2 to 1 differential piston rod, or double end rod. Many special mountings and large size cylinders are also available built to order. Write for Bulletin 35.

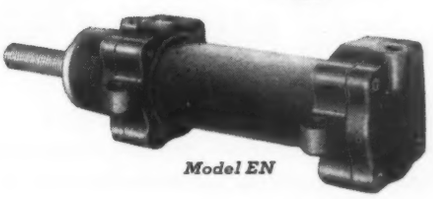
Hannifin Manufacturing Company, 621-631 South Kolmar Avenue, Chicago 24, Illinois.



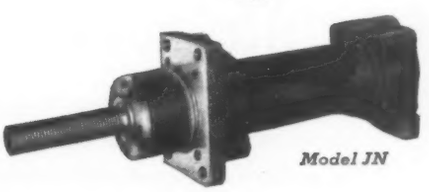
Model BN



Model CN



Model EN

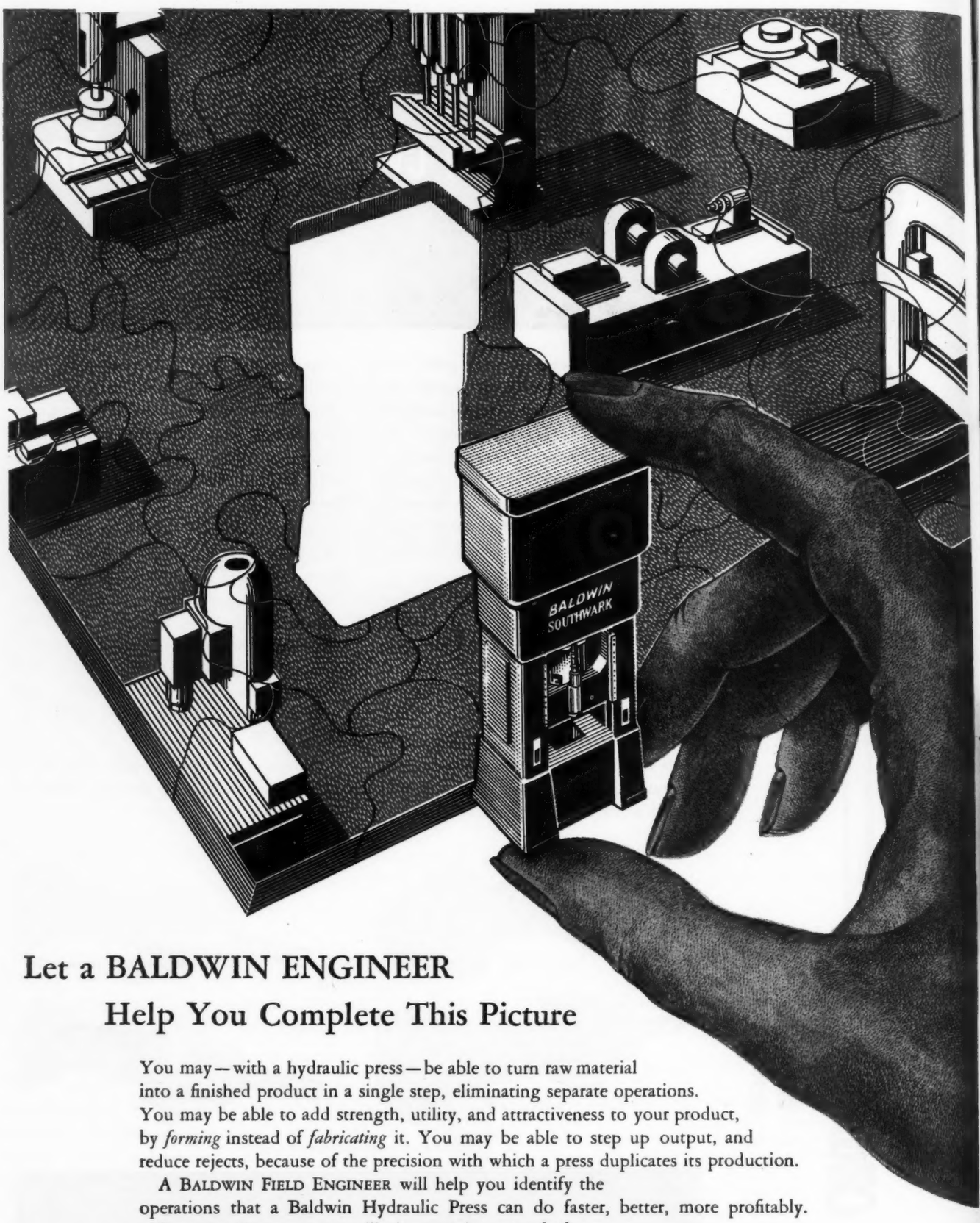


Model JN

Many other mountings available

HANNIFIN

MACHINERY, August, 1946—127



Let a BALDWIN ENGINEER Help You Complete This Picture

You may—with a hydraulic press—be able to turn raw material into a finished product in a single step, eliminating separate operations. You may be able to add strength, utility, and attractiveness to your product, by *forming* instead of *fabricating* it. You may be able to step up output, and reduce rejects, because of the precision with which a press duplicates its production.

A BALDWIN FIELD ENGINEER will help you identify the operations that a Baldwin Hydraulic Press can do faster, better, more profitably.

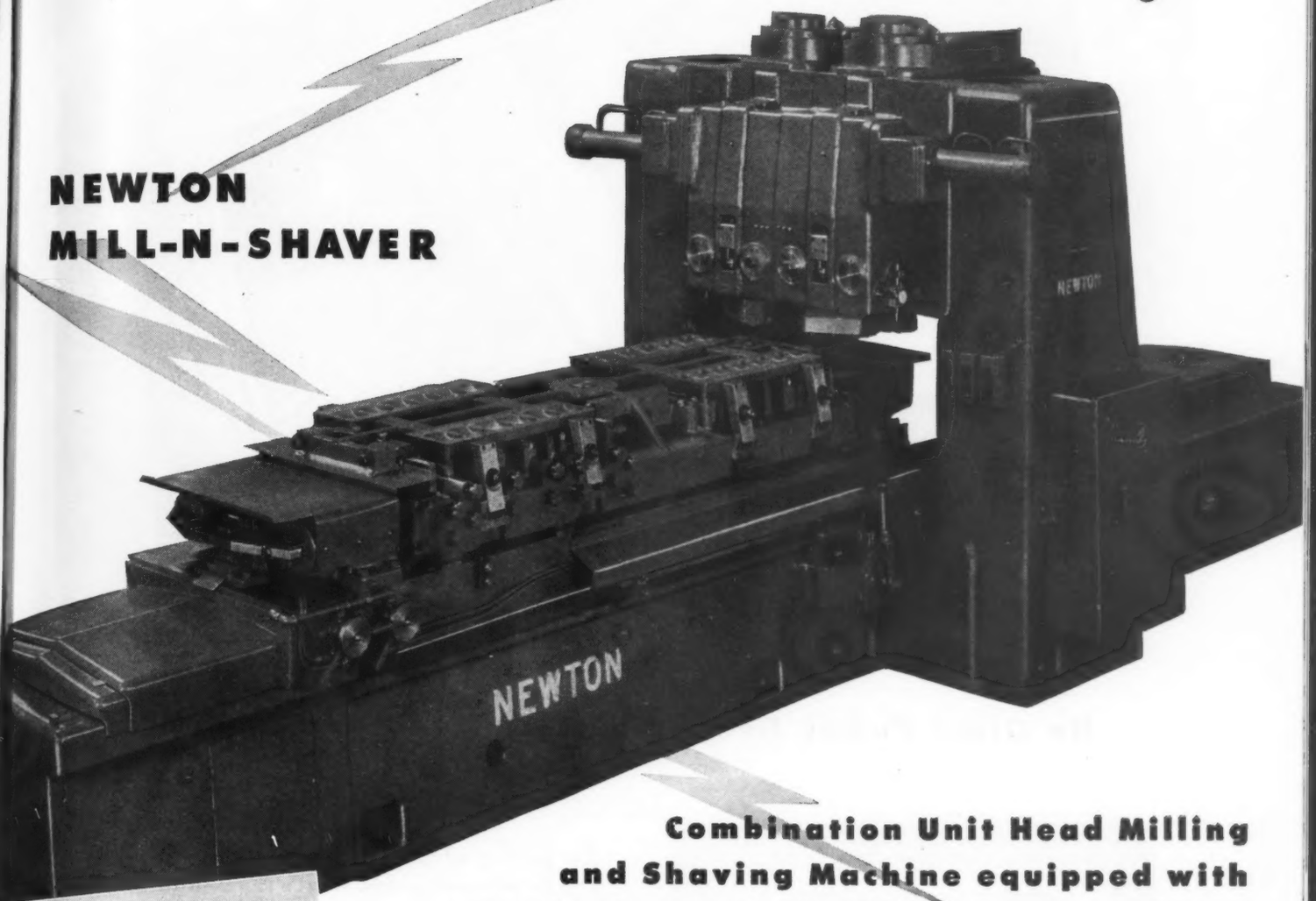
BALDWIN ENGINEERING will give you the *custom-built* quality and features that can be designed into the *standard* line of Baldwin presses.

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES

The Baldwin Locomotive Works, Locomotive & Southwark Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, St. Louis, Washington, Boston, San Francisco, Cleveland, Detroit, Pittsburgh, Houston, Birmingham, Norfolk.

TWO SEPARATE OPERATIONS in the time required for rough milling—alone!

NEWTON MILL-N-SHAVER



Combination Unit Head Milling and Shaving Machine equipped with two single vertical milling heads and two finish shaving heads. Hydraulic feed to table.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

The Newton Mill-N-Shaver performs two complete operations at one pass of the table. It rough mills at milling speed and finish shaves on the return, at the rapid traverse speed. This machine produces a perfect gasket surface. Two separate operations in exactly the time ordinarily required for rough milling alone. The Newton Mill-N-Shaver is designed to both step-up your production and reduce your costs on the types of work for which this machine is adapted. For detailed information, write for Bulletin No. 580.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

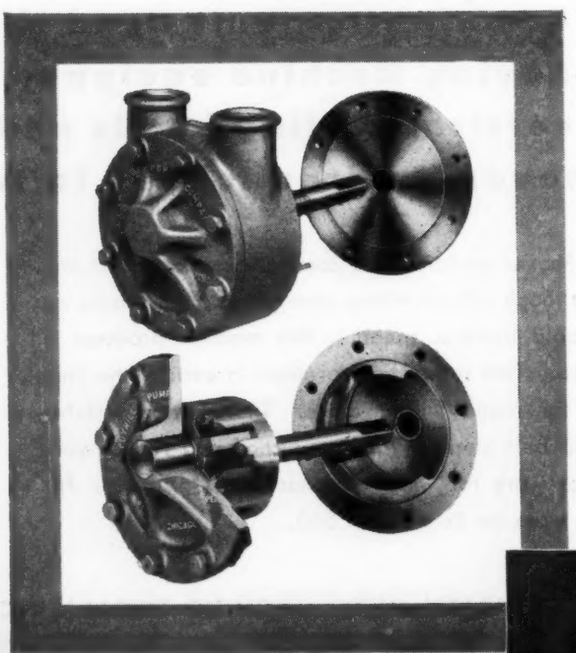
CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

Photo, Courtesy R. K. LeBlond Machine Tool Co.

No Other Pumps Fit the Job Like Tuthill Stripped Models



For positive lubrication, you can always depend on Tuthill small pumps. What's more—with Tuthill Stripped Pumps, you can build the pumping unit directly into the design of your machine as shown in the illustration above. Compact and precision-built, these internal-gear rotary pumps are furnished in two types—as Model S without mounting bracket; and as Model SA without housing (pumping elements only). No question about it—Tuthill Stripped Pumps improve appearance, save space, material and money. Capacities from 1 to 50 g.p.m. Also available in the automatic reversing type.

Write for Tuthill Stripped Pump Bulletin

TUTHILL

TUTHILL PUMP COMPANY • 939 EAST 95th STREET • CHICAGO 19, ILLINOIS

TO HER TRAINED EAR... *Every*

AMERICAN PHILLIPS BOLT and SCREW

Even Has to *RING* True!

Every modern method of inspection and quality-control is used in American's plant. And American's inspectors become so highly efficient . . . so keenly attuned to their work . . . that even their ears become "educated." For example, these final inspectors can literally "hear" the presence of an undiscovered blank, an imperfect screw, or a screw of some other metal than that specified in the particular order under inspection. For as they pass their forks through each box, the slightest variations in sound of metal against metal are detected . . . and out comes the offending screw or bolt.

Here's another good reason why there's a higher "perfection-percentage" in every order for American Phillips Screws and Bolts . . . at least 144 perfect screws in every gross-box . . . regardless of type of screw or kind of metal: steel, brass, commercial bronze, stainless steel, aluminum, monel, everdur (silicon bronze). Add to this the basic American Phillips advantages . . . fast and fumble-proof handling, automatically straight *and 50% faster* driving, positive protection against split screwheads and scarred work-surfaces . . . and you have gained one of the few major cost-cuts that *any* plant can gain today.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. *Detroit 2:* 502 Stephenson Bldg.

AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

BALLFLEX

ANGULAR AND AXIAL

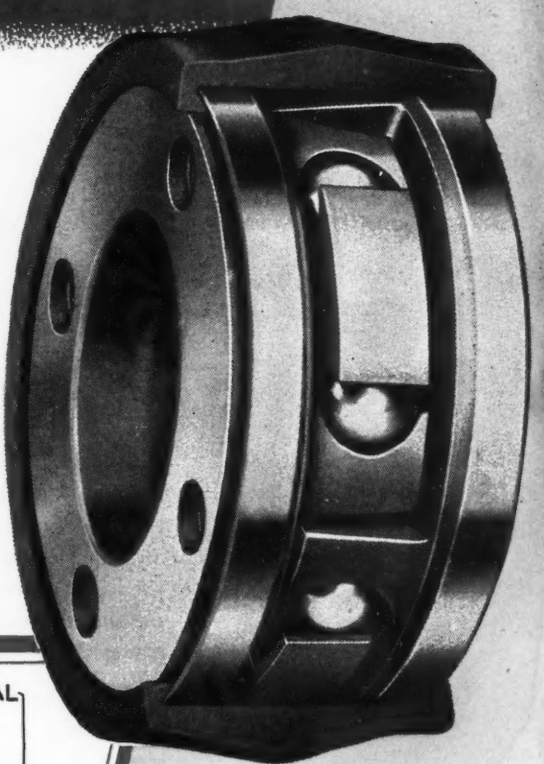
Anti-Friction Flexible Coupling

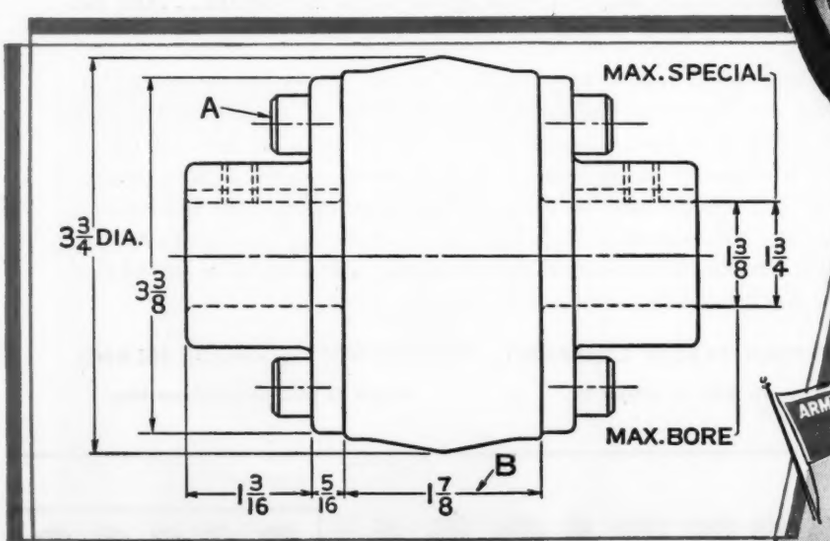
Ballflex provides flexibility—both angular and axial—by the rolling motion of hardened steel balls, insuring distinct advantages in performance as well as long life for both coupling and mounting bearings.

The load necessary to flex rubber and fibre discs or move sliding members—equalled by the reaction on mounting bearings—is one of the reasons for bearing and coupling failure, with subsequent down time.

Ballflex has no rubber or fibre discs—no sliding members. The only flexible element is the synthetic product used in the overall seal that retains the factory packed lubricant and keeps out dust, dirt and liquids, and is impervious to oil.

Free rolling movement in any direction eliminates side thrust and the bending or springing of parts. It accommodates parallel misalignment up to 1/8" and/or angularity up to 3°.





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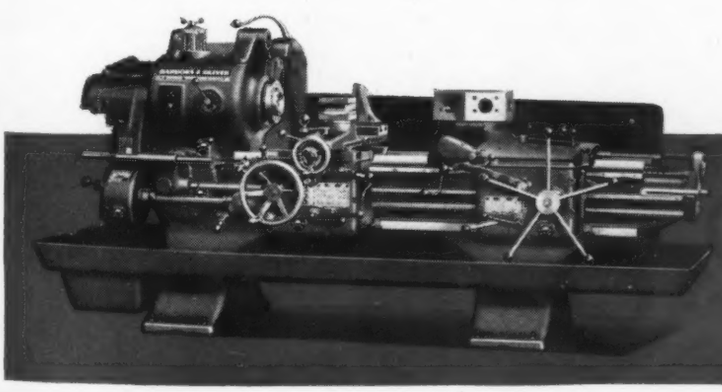

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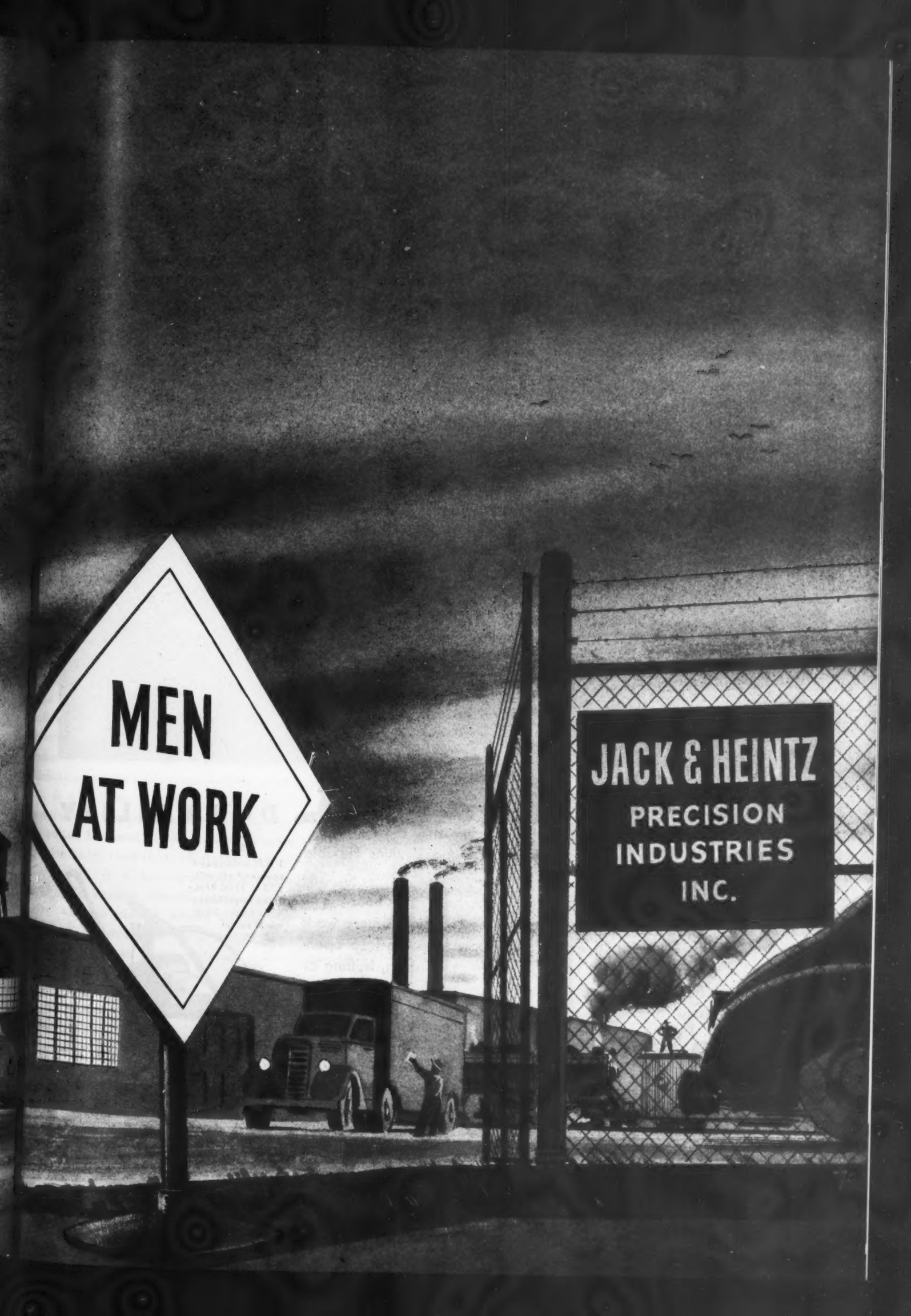
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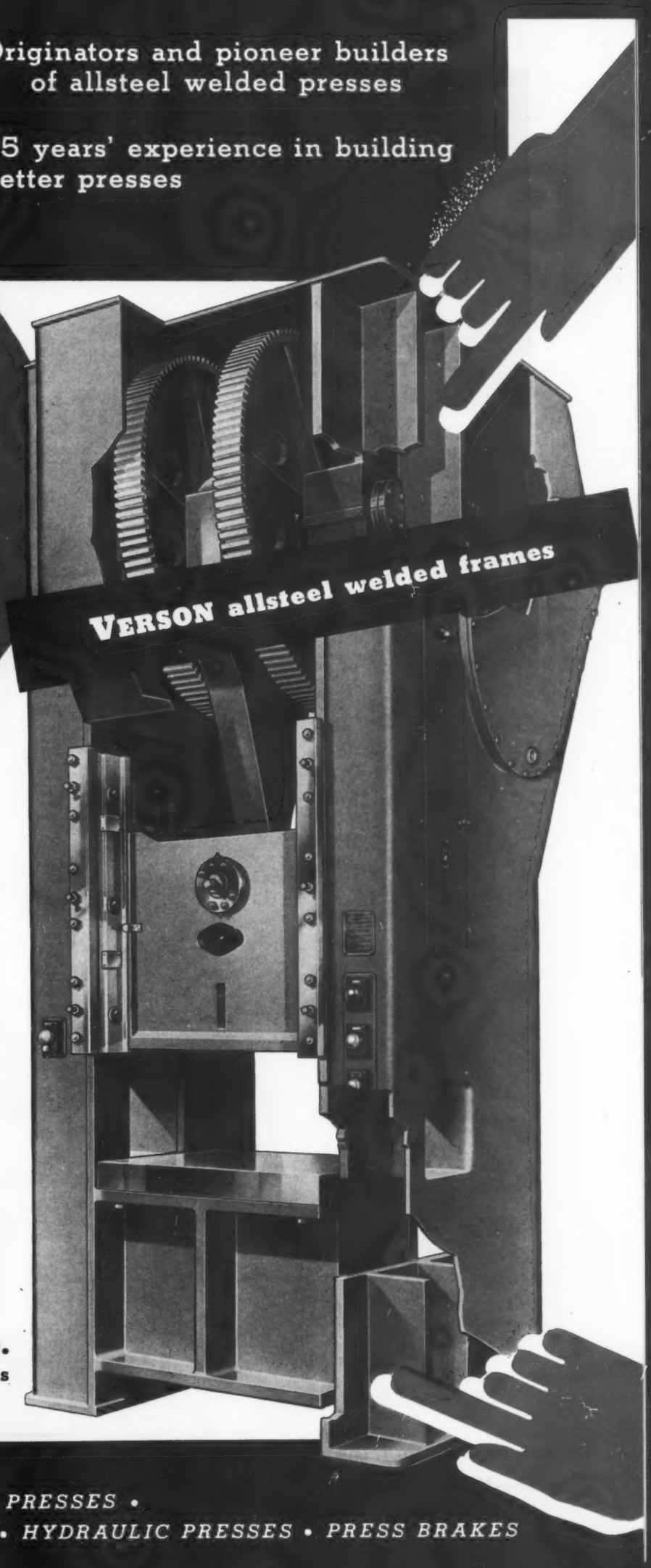

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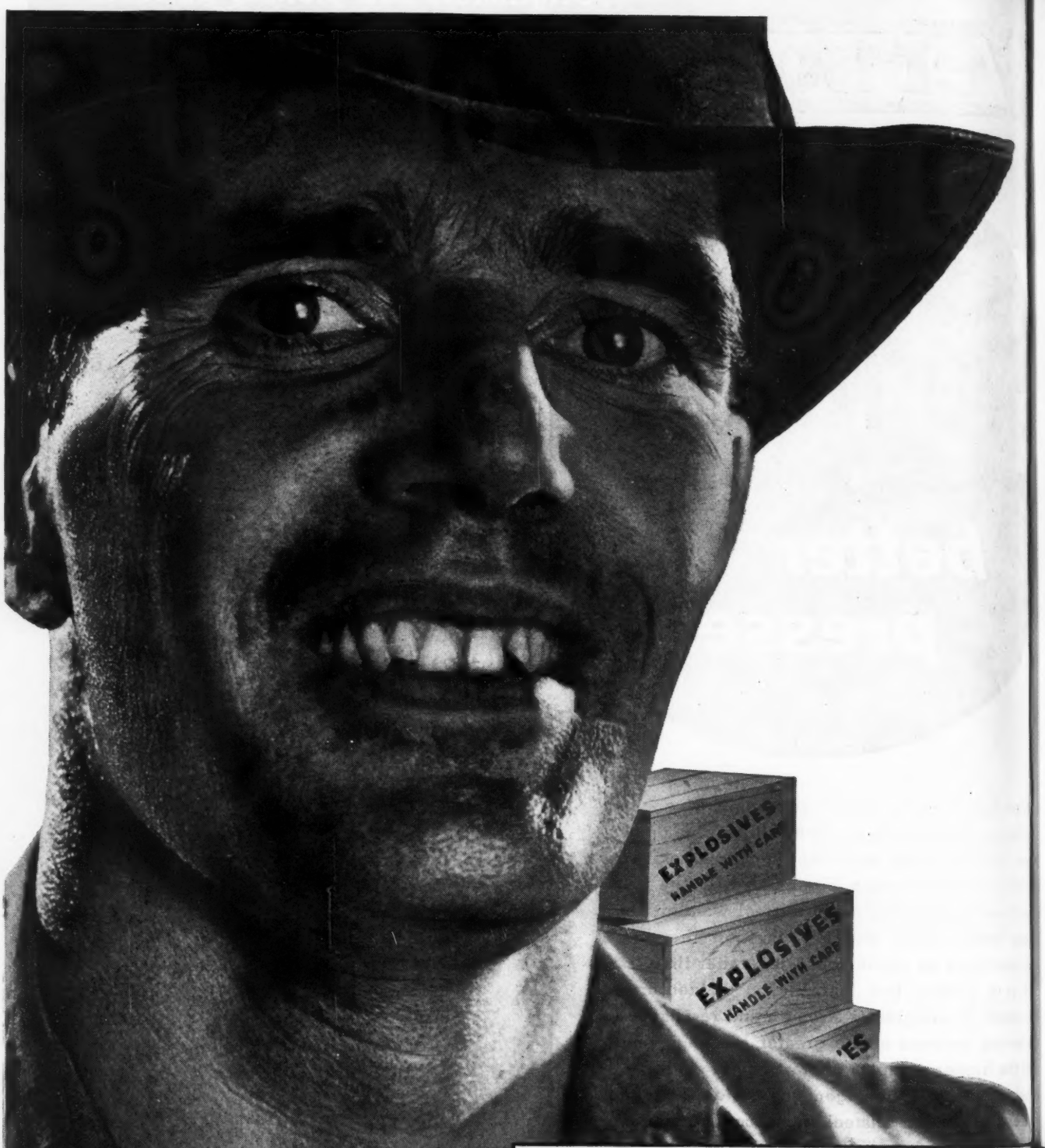

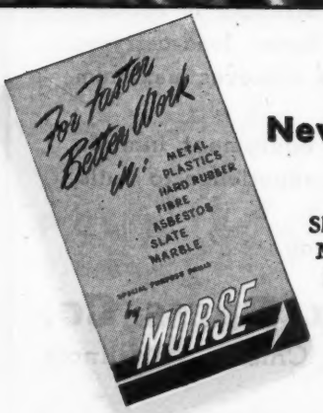

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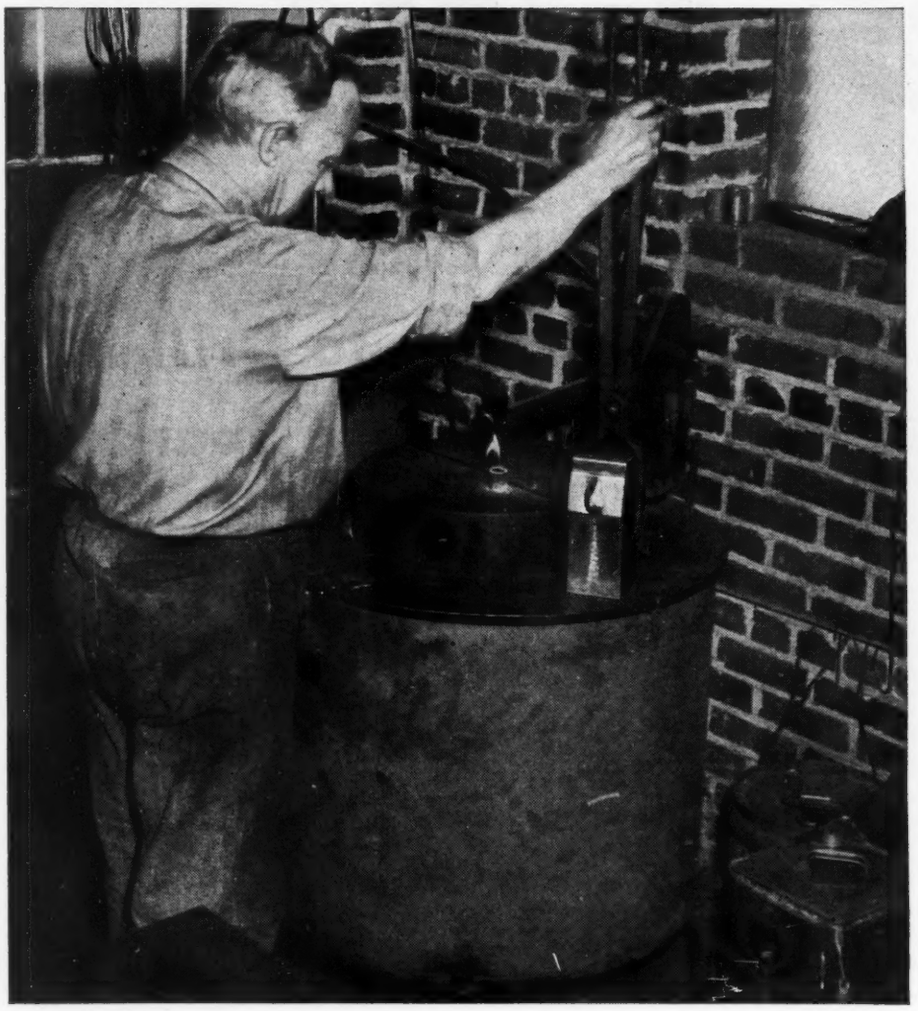

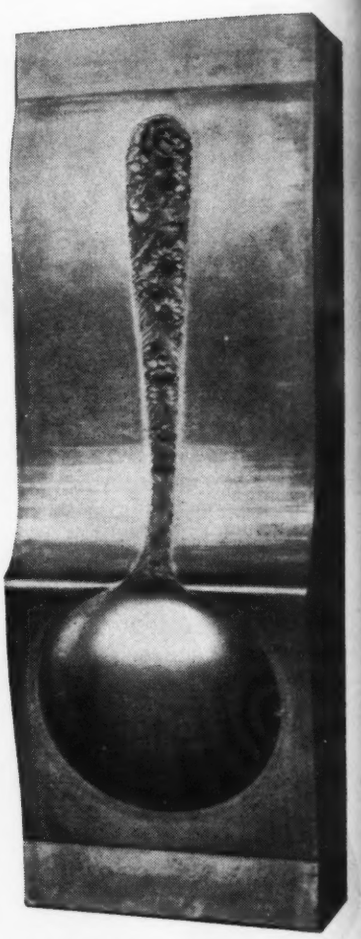

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1. Harden all tools (except high-speed steel) by the Vapocarb-Hump Method. It prevents scale and decarb, heats as directed, and records as it goes along. It enables the heat-treater to harden for longest tool life.

2. The second suggestion is to temper all tools by the Homo Method. It uses electrically-heated air, under forced circulation, as the heating medium, to relieve stresses uniformly from all sides; gives automatic control of the accurate heating which tempers the tool to its job.

An L&N engineer will be glad to give details about these methods, or will send catalogs, as you prefer. He can probably arrange for you to talk to someone who is using the methods on problems like yours.

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AUGUST, 1946 MACHINERY VOL. 52 • NO. 12

Cold forming

OLDSMOBILE THREE-PIECE BUMPERS

Unique Press Operations Produce the Three-Piece Bumpers from Low-Alloy High-Tensile Steel as Described Here — A Future Article will Deal with the Automatic Polishing and Electroplating of These Bumpers

By CHARLES O. HERB

AUTOMOBILE bumpers have evolved from the flat narrow bars of spring steel which provided a meager amount of protection on early cars to the wide and deep bumpers of the 1946 automobiles, which combine greatly increased strength with pleasing appearance. The difference in bumper design is about as great as the difference between the "Merry Oldsmobile" of the early 1900's and the latest models of the Oldsmobile Division. The latest models are provided with three-piece "wrap-around" bumpers which extend from the front or rear of the car and along the sides of the fenders. The rear bumpers fit into recesses in the fenders, with the outer surface of the bumpers flush with the fender side walls.

Previous to the adoption of the present models

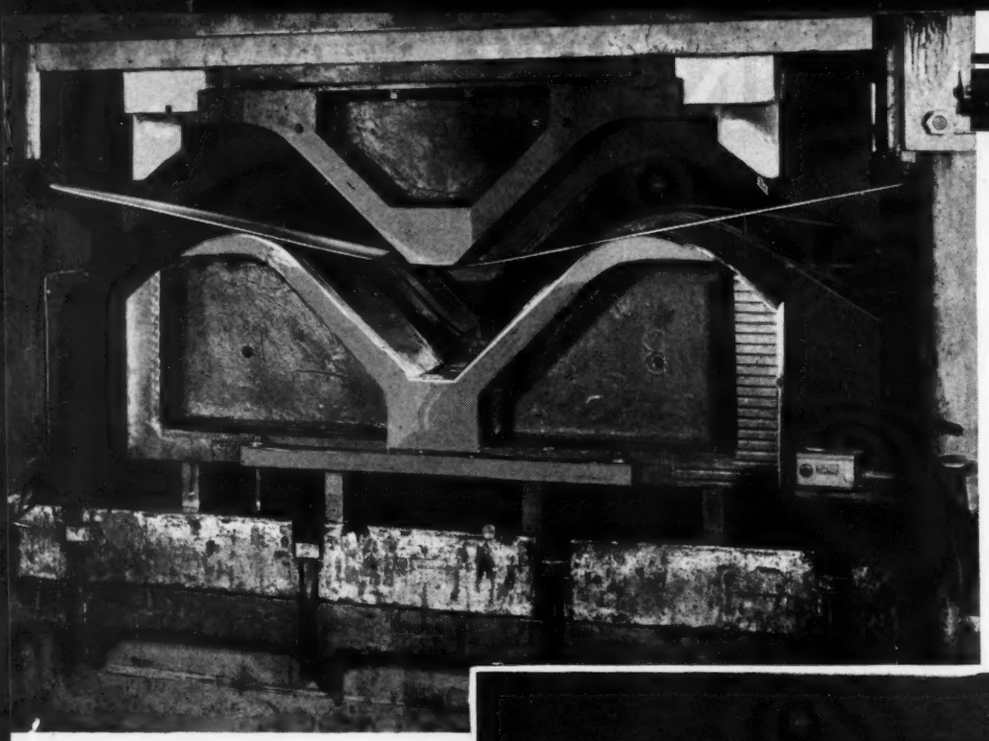


Fig. 1. View of the Preforming Die in which the Sheet-steel Blanks are Shaped to Approximate Outline of Two Rear Bumper Sections

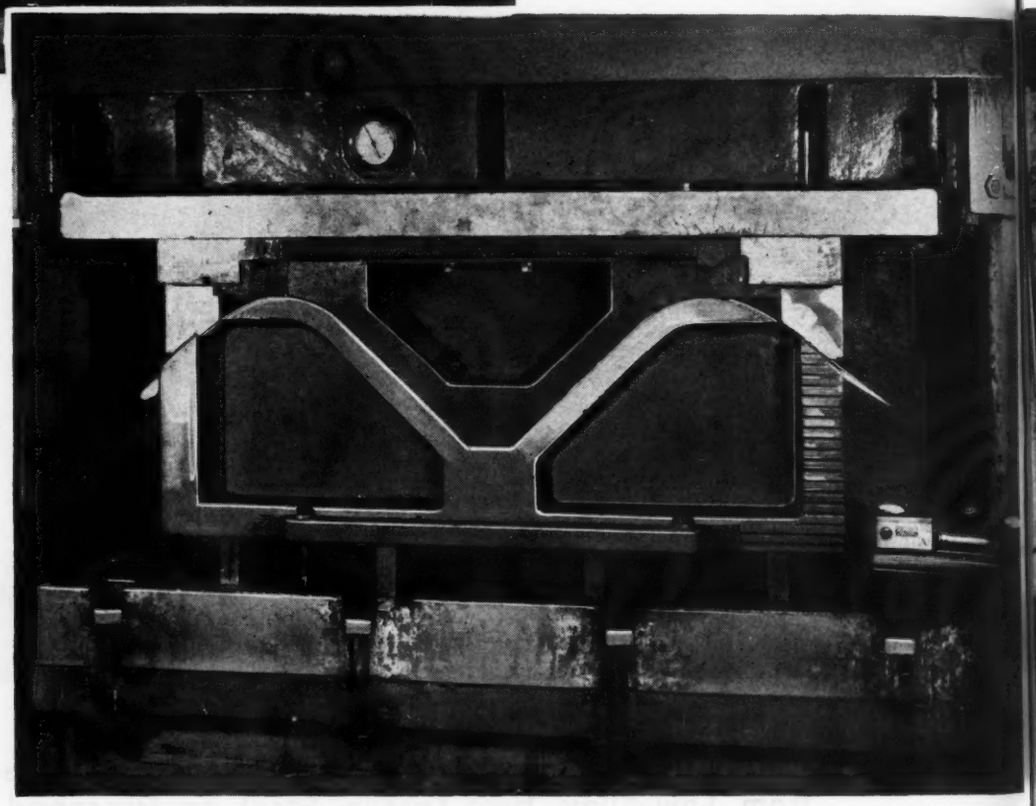


Fig. 2. View of the Preforming Die Shown in Fig. 1, with the Punch at the Lower End of Its Stroke

the bumpers made for Oldsmobiles, as well as for other cars, were of one-piece construction, and were produced by hot-forming. In 1940, the engineering department designed bumpers that were entirely different in contour and cross-section. The manufacturing division informed the engineering department that hot-forming of such bumpers would be too expensive, because of the difficulty of holding them to the specified contour and the excessive amount of polishing and metal finishing that would be necessary to eliminate surface imperfections resulting from the hot-forming. Experiments were then conducted in cold-forming these bumper bars from a cold-rolled, low-alloy, high-tensile steel. It was learned that this method of bumper manufacture would effect considerable savings over hot-forming, inasmuch as the polishing and finishing of cold-rolled material is considerably less costly than the finishing and polishing of hot-formed material.

As a result of this investigation, cold-formed bumpers made from cold-rolled, low-alloy, high-tensile steel were adopted for the rear end of the 1941 Oldsmobiles. The following year, bumpers of this type were adopted for both front and rear, and this practice was followed up to the beginning of the war, when automobile production was stopped.

One of the important reconversion projects of

the Oldsmobile Division has been the development and installation of equipment for producing cold-formed bumpers. Large presses have been fitted with dies for making the curved bumper parts by the methods to be described in this article. A separate automatic polishing and electroplating department has been set up.

The first operation in the press shop is to cut the steel blanks to a developed outline that will result in a bumper of the exact shape desired without the necessity of removing much excess stock. As two opposite curved bumper ends are produced in one piece during the preliminary press operations, the blank sheet is long enough to provide for two bumper sections, with excess material in the center of the blank which is utilized for locating purposes in the dies.

In the following, the operations performed in producing the curved sections of rear bumpers will be described. The procedure in producing the curved sections of front bumpers, however, is practically the same. For the blanking operation, use is made of a sectional die on the press bed. There is a corresponding sectional punch construction on the ram with a flat spring-backed stripper pad on the inside that closely follows the outline of the punch shearing edges. This stripper pad extends the entire length of the punch.

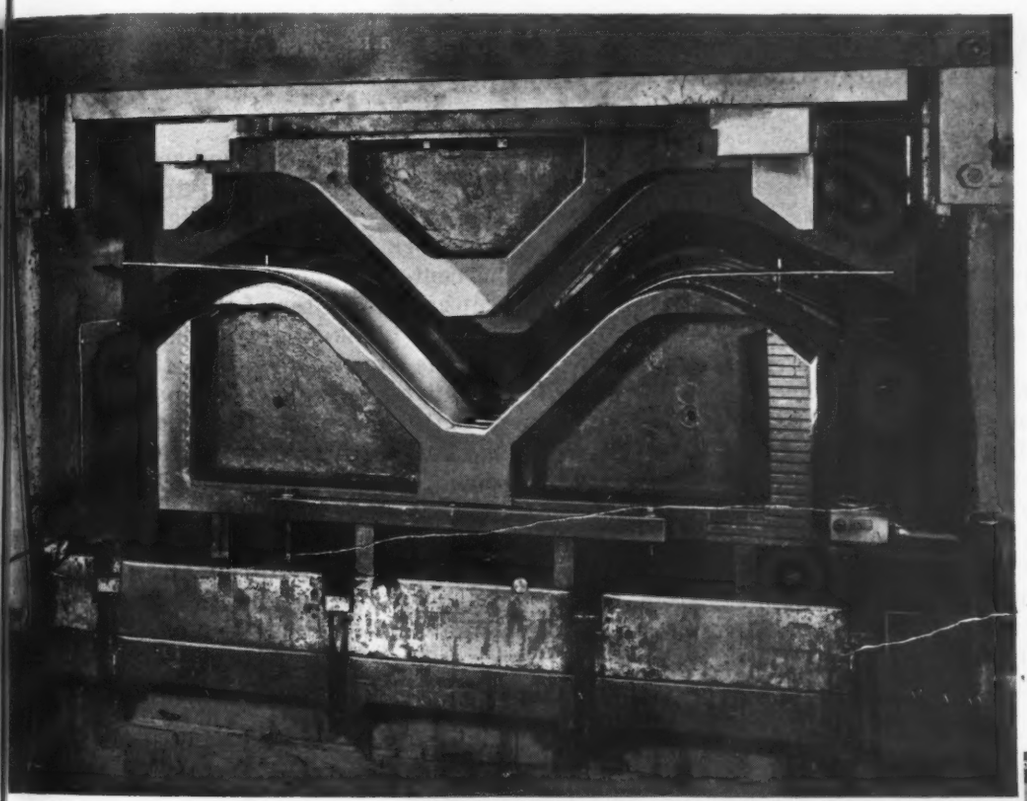


Fig. 3. View of the Pre-forming Die after the Operation, with the Punch Raised to Show the Appearance of the Pre-formed Double Bumper Section

Fig. 4. View of the Drawing Dies on Opposite Side of the Press in which the Bumper Blanks are Pre-formed

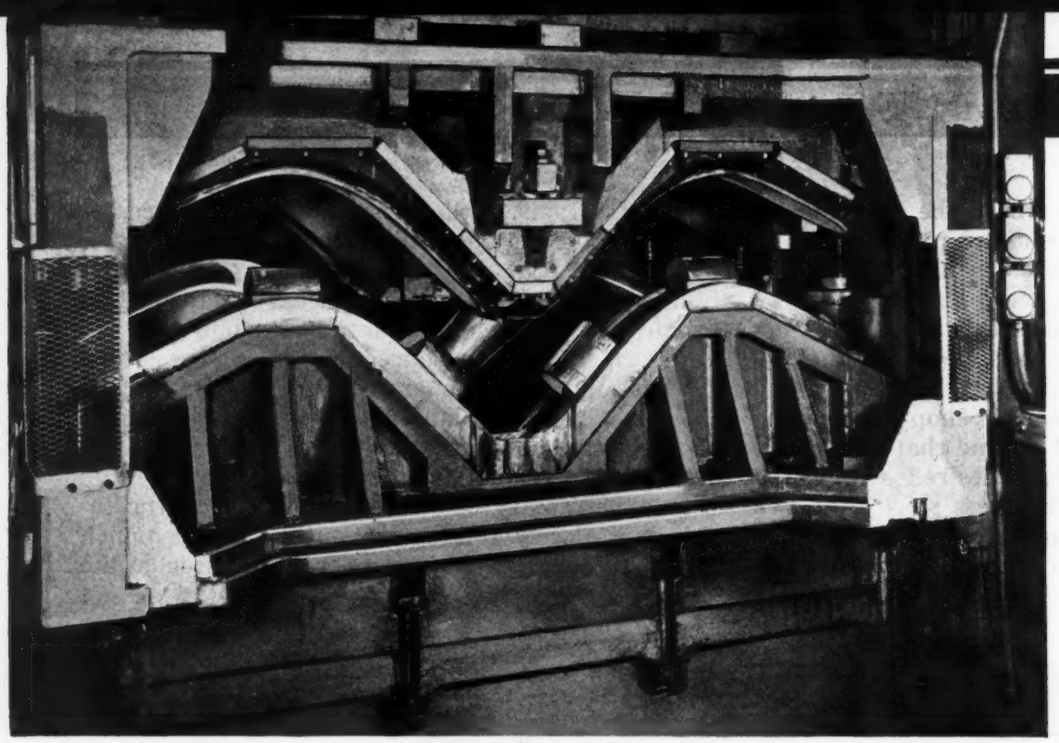


Fig. 5. Trimming Press with Dies Open to Show Arrangement of Work Locating Blocks on Lower Die and the Sectional Punch Members

Simultaneously with the blanking, an elongated hole is pierced in the center of the blank for locating purposes in succeeding operations. This hole is somewhat larger in diameter in the center than the width of the elongated portions or slots on each side. Small circular holes for locating purposes are also pierced in the blank about midway between the center and each end.

After the blanking operation, the steel sheet is pre-formed in a Bliss 750-ton single-action press by employing the die set seen in Fig. 1. The blank is located lengthwise and sidewise by two small pins which project upward from the die member. These pins are more clearly seen in Fig. 3. When the press ram descends into the position seen in Fig. 2, the blank is bent to the rough outline of the finished bumper, but the steel sheet remains flat in cross-section. The appearance of the blank at the end of this operation is as illustrated in Fig. 3.

The same press is fitted with a second set of dies on the opposite side which perform the first drawing operation. These dies are seen in Fig. 4. For this operation, the work is located from the elongated hole in the center of the bumper, which is seated over two pins in the center of the die. When the ram comes down, a blank-holder which extends completely around the punch first grips the sheet by pressing it down firmly on a pressure pad. The latter runs along both sides of the stationary bottom die, which is actually the punch, since the die cavity is in the member attached to the ram. As the ram continues its downward movement, the blank-holder, bumper material, and pressure pad go down together. The stock is gradually pulled from between the blank-holder and the pressure pad as the upper die member comes down over the lower die. The action of the blank-holder and pressure pad is such that the bumper parts are

Fig. 6. Punch and Die Equipment Employed for Turning down the Flange which Extends around the Double Bumper Stamping

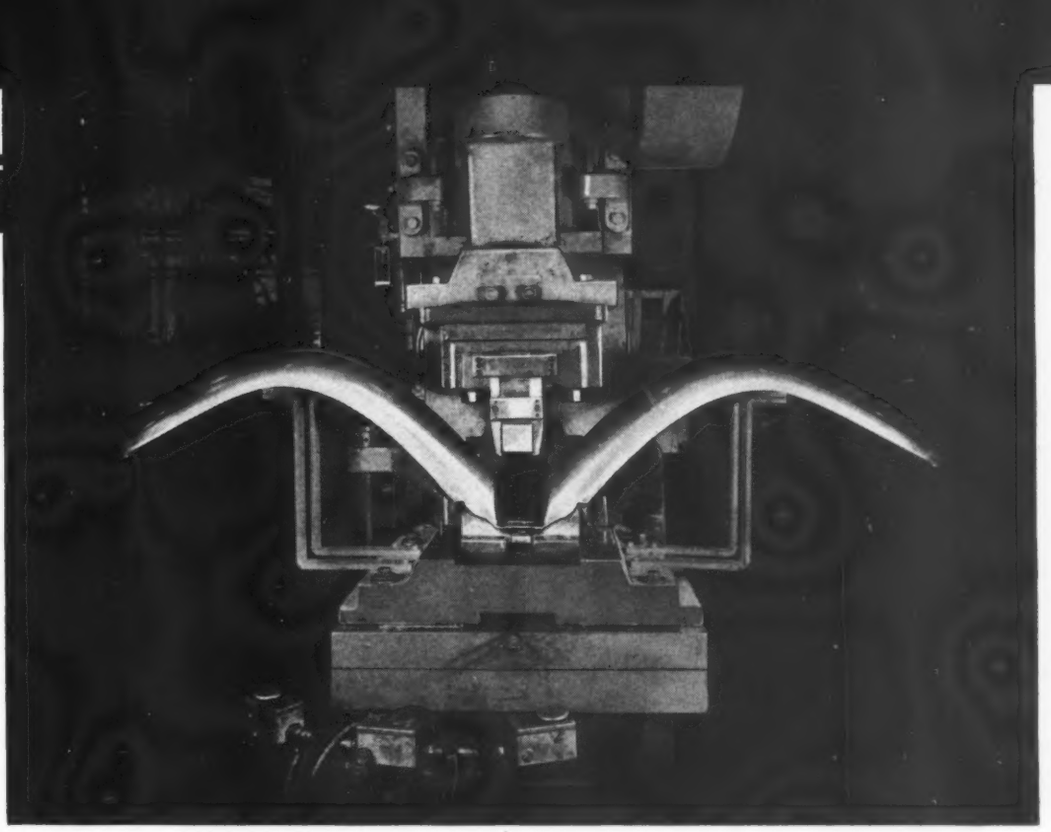


Fig. 7. Equipment Employed for Cutting the Two Bumper Sections apart after They have been Completely Formed as a Single Stamping

formed without the development of wrinkles. The blank-holder is spring-backed. By the use of two dies on one press, two pre-formed and drawn bumper ends are obtained with each stroke of the machine.

After drawing, the excess stock is trimmed from the flange, which extends all around the bumper stamping. This is done on a Bliss 350-ton press equipped with the die illustrated in Fig. 5. The bumpers are located in this die by means of rounded steel blocks welded to the die, the inside edges of the bumper being registered against these blocks. There is a stripper in the ram die member which recedes into the punch during trimming, so as to expose the cutting edges. The stripper is spring-backed. The punch is constructed from several sections in which shearing edges are incorporated.

The next step after trimming is to start the formation of turned-under flanges on the bumpers. In order to accomplish this, the turned-outward flanges previously formed must first be bent down. This is done on a press provided with the internal or punch members on the bed and the external or die members on the ram, as illustrated in Fig. 6. When the ram descends, the turned-outward flanges are bent straight down all around the bumper sections. There is a stripper in the center of the ram die.

The next operation consists of cutting the two bumper sections apart. This is accomplished on a press arranged as shown in Fig. 7. The bumpers are self-stripping. This will be apparent in Fig. 8, which shows one bumper section having been removed from the set-up and the second bumper still in place.

Four separate operations are next performed on one machine, which is provided with four sets of double dies, so that eight bumper sections are

Fig. 8. Another View of the Horning Press Shown in Fig. 7 at End of Bumper Parting Operation. The Die Construction is Clearly Shown

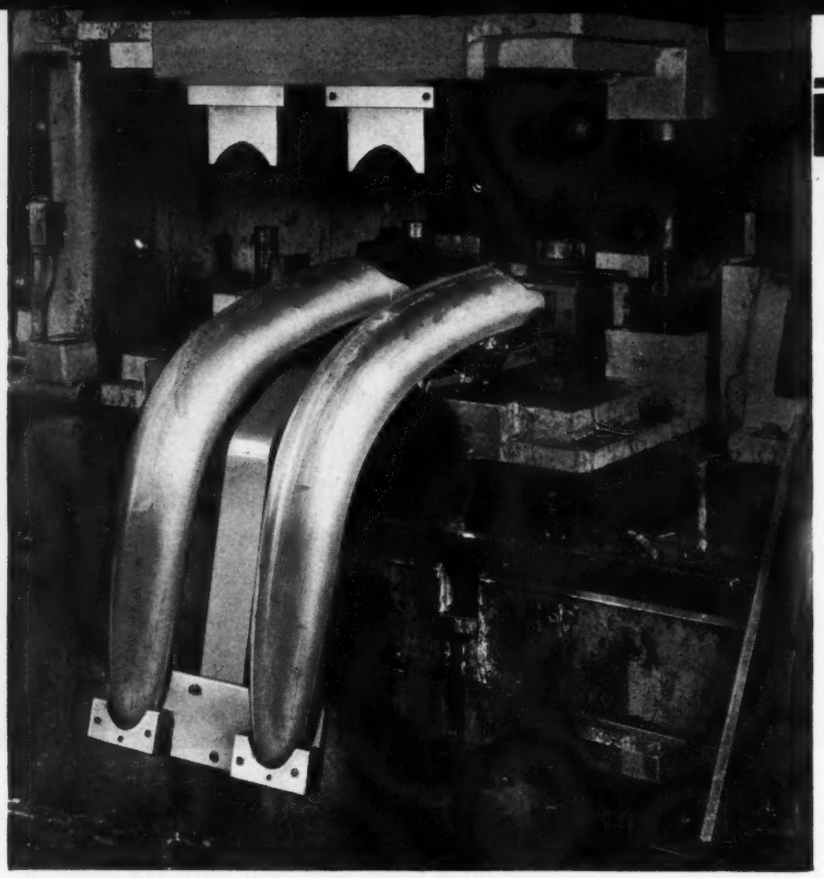


Fig. 9. (Left) Punch and Die Equipment Employed for Piercing a Square Jack-hole in the Inner End of Two Bumper Sections and for Simultaneously Forming a Flange around Inside of Hole

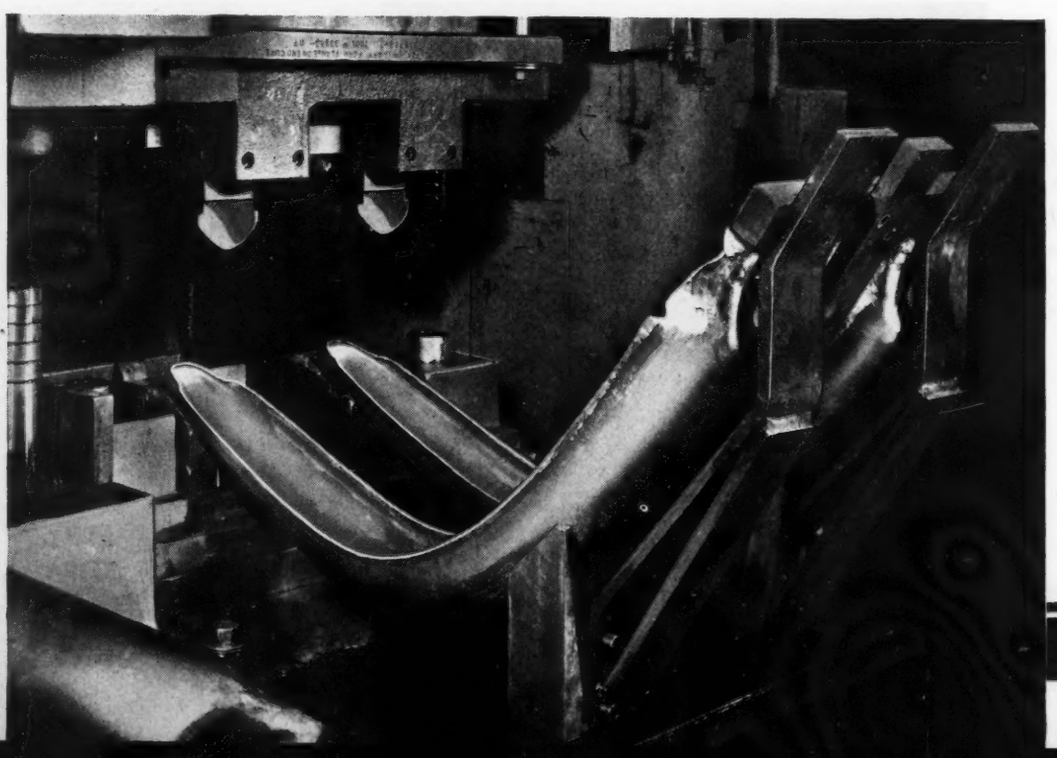
Fig. 10. (Below) Curling the Inner Ends of Two Bumper Sections with These Ends of the Parts Accurately Located over Pins

actually worked upon with each stroke of the press ram. The first operation on this press, which is shown in the heading illustration, consists of piercing and flanging a jack-hole through the inner end of two bumper sections. This is done with the die set shown in Fig. 9. The jack-hole is about 1 1/4 inches in diameter and has a flange on the inside.

The second operation on this press, which is performed with the die set illustrated in Fig. 10, consists of curling the bumper section along the inner end. This end of each bumper is located by slipping it over a pin on the die.

The third operation, for which the die set illustrated in Fig. 11 is employed, consists of flanging the nose end of the bumper for a distance of 3 or 4 inches from the end. Finally, the fourth die trims the inner end of two bumper sections and pierces small holes in the ends. This operation is performed with the die shown in Fig. 12. Piercing is performed by slides on the die base, which are actuated by a wedge-shaped block on the press ram.

The next operation completes the formation of the turned-under flanges which extend the full length of the bumper sections. Four dies are provided so that one flange can be formed simultaneously on four bumper parts. To accomplish this operation, it is necessary for each bumper part to be placed in two dies. The first die bends the flange along one side, the flange along the opposite side being bent subsequently by the second die.



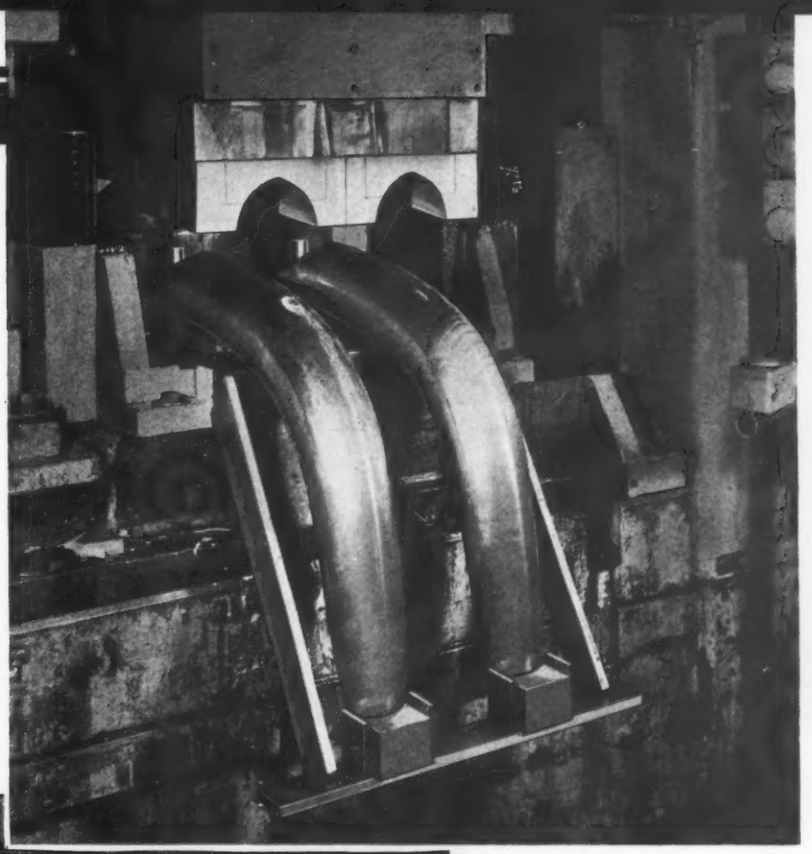


Fig. 11. (Right) Flanging the Nose End of Two Bumper Parts for a Distance of 3 or 4 Inches from the Bumper End

Fig. 12. (Below) Final Operation on the Four-die Press, which Consists of Trimming and Piercing the Inner End of Two Bumper Parts

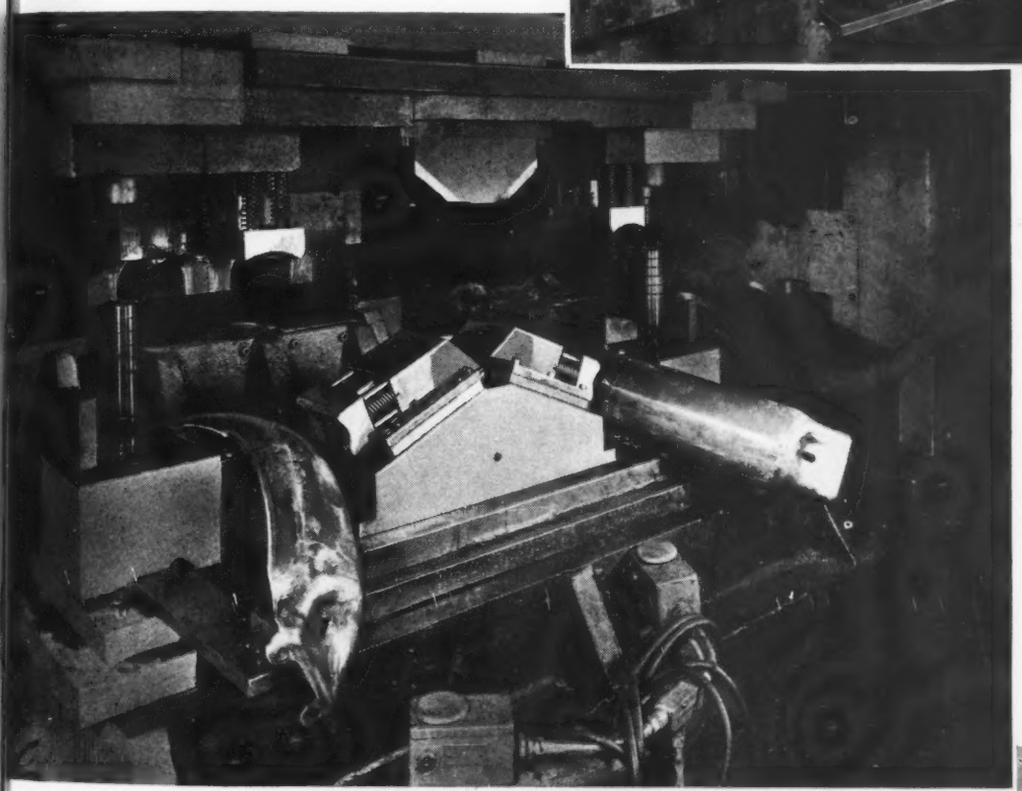


Fig. 13. (Below) Die Set-up Employed for Bending under the Bumper Edges to Complete the Cross-sectional Shape. Each Bumper Part Must be Placed in Two Dies to Complete the Operation

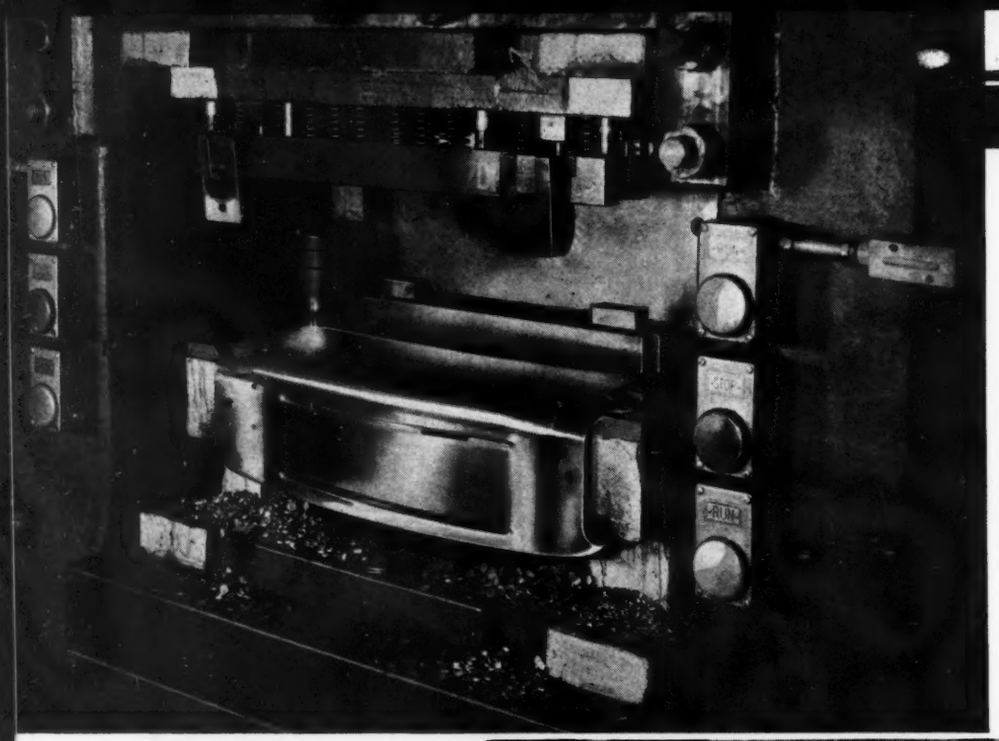


Fig. 14. (Left) Embossing the Name "Oldsmobile" on the Center Section of Rear Bumpers after Electroplating. Two Holes are being Pierced Simultaneously

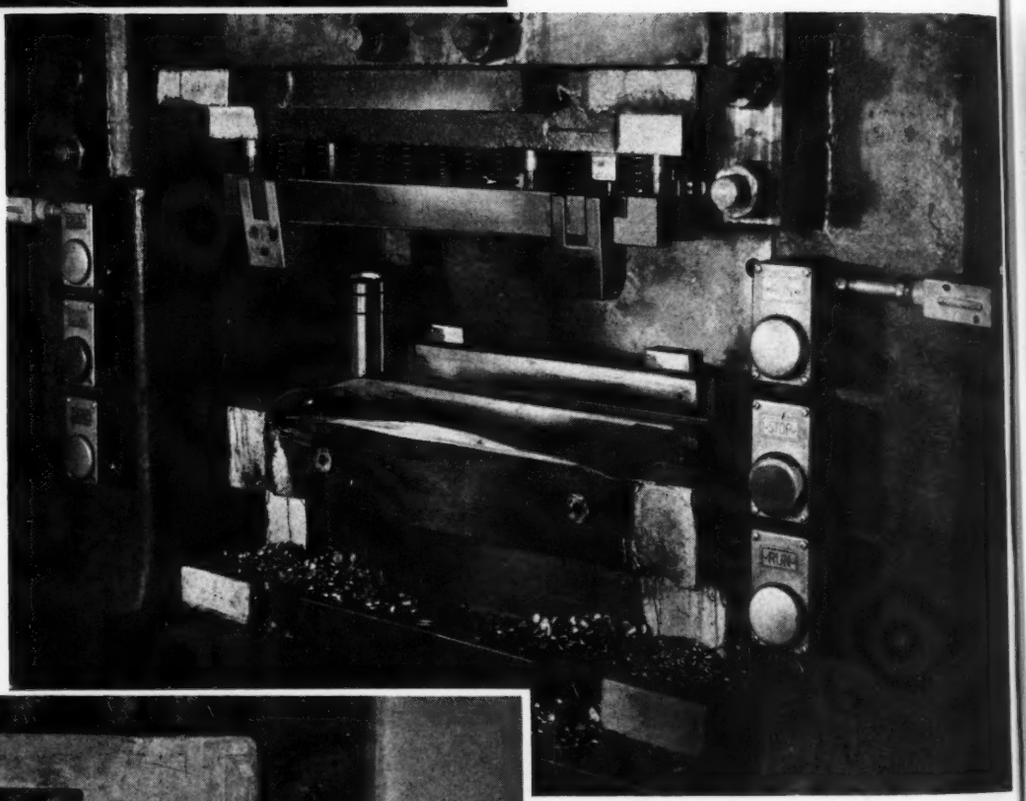


Fig. 15. (Right) View of the Rear Bumper Center Section Embossing Die with the Work Removed to Illustrate the Die Construction Clearly

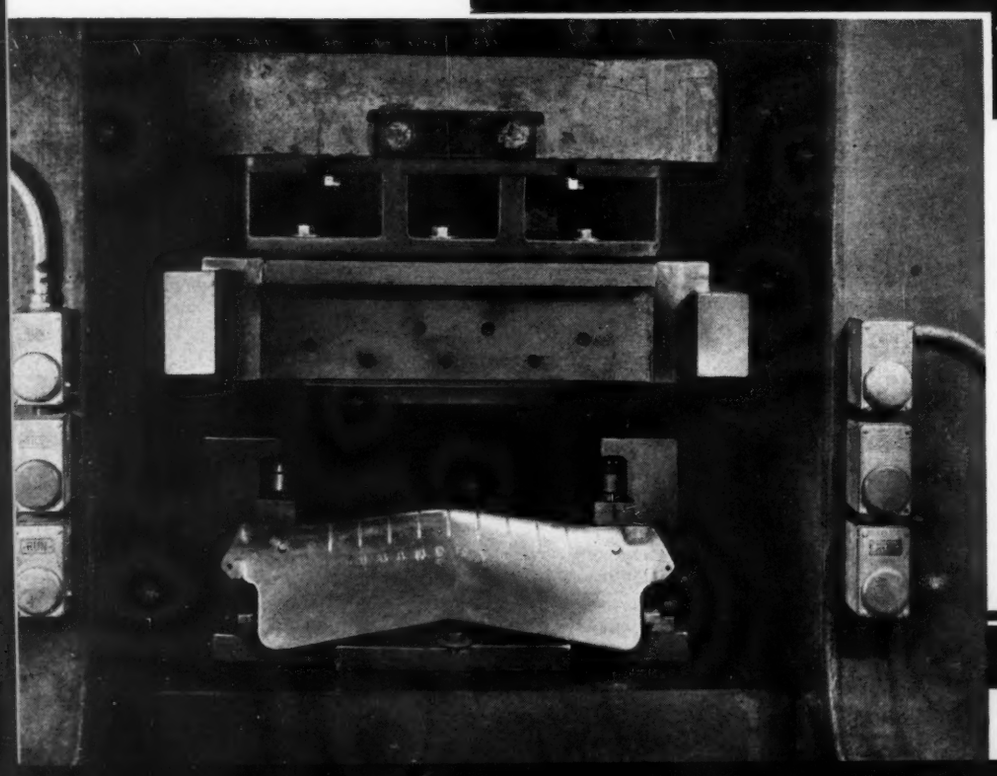


Fig. 16. (Left) Punch and Die Employed for Embossing Decorative Grooves in the Front Bumper Center Sections

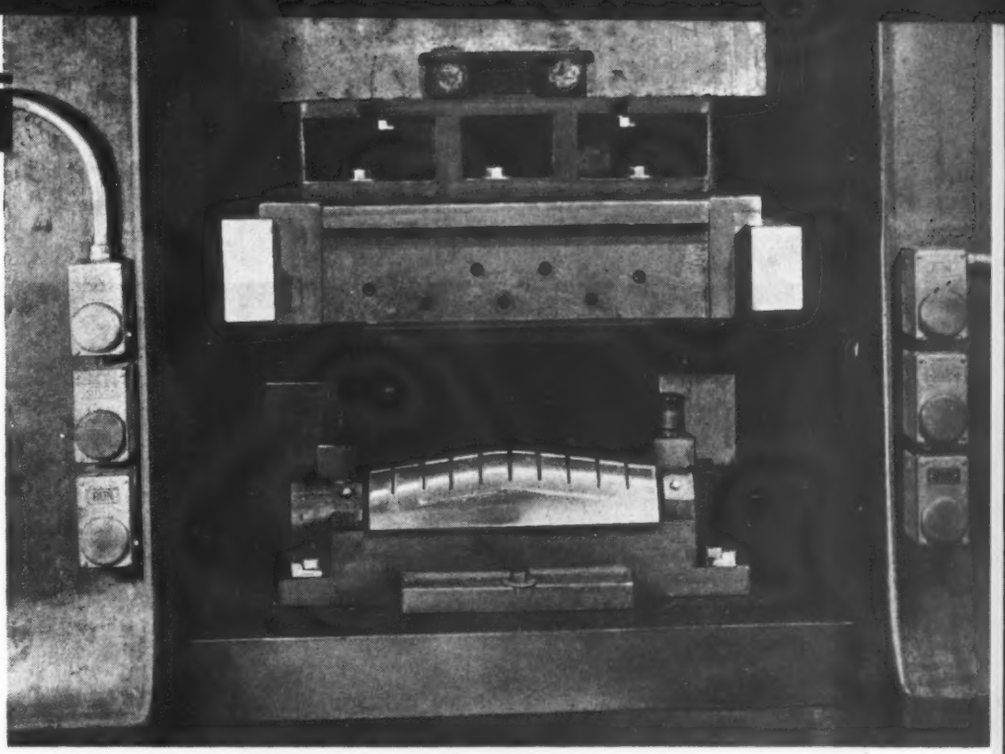


Fig. 17. (Right) Another View of the Die Set Shown in Fig. 16, with the Work Removed to Show the Design of the Embossing Die and the Arrangement of Pins for Locating the Work

Each die is cut away around the bottom to enable the work to be removed from the die after the flange has been formed. For this operation, the die members on the press bed consist of forms corresponding to the outline of the bumpers, on which the bumpers fit snugly. When the punch comes down, the flange on the upper side of each bumper part is tucked under a ledge on the form.

Up to this point in the operations, there is always some spring-back in the bumper parts, but blank-holders on the presses insure proper seating of the work. Blank-holders are also used on the flange-forming operations, but when the flanges have been formed, the cross-section of the bumper is such that there can be no spring-back.

Fig. 14 shows the set of dies used for embossing the name "Oldsmobile" on the top of the center section of the rear bumpers, two holes being pierced at the same time. It will be observed that this section has a recess large enough to receive the automobile license plate. A close-up view of the punch and die with the work removed is seen in Fig. 15. Fig. 16 shows the punch and die employed for embossing a series of decorative grooves on the center section of the front bumpers, while Fig. 17 illustrates the simple die-block used for this operation.

When Coolants Should be Used with Carbide Tools

BEST results are usually obtained in machining with carbides by cutting dry, according to Fred W. Lucht, development engineer of Carboloy Company, Inc. However, coolants may be required on certain jobs when it is necessary to maintain a high degree of dimensional accuracy, in order to avoid distortion of the work-piece. In such cases, the use of a solution consisting of 1 part of soluble oil to 30 or 40 parts of water is recommended. This variation in the proportion of water to oil is prescribed because of the differences in the hardness of water in various sections of the country. With the 30 or 40 to 1 mixture, the ways of machine tools remain free from rust.

Coolants should be supplied in large quantities for carbide cutting operations—never in dribbles. A copious flow of the coolant should be directed toward the cut underneath the tool or at the cut from the side of the tool where the chip flow has the least tendency to interrupt the flow of the cutting fluid. An intermittent flow of coolant, whether caused by an inadequate amount of coolant, an "umbrella" action of the chip, or any other reason, tends to reduce tool life. The soluble oil solution has given good results on all types of carbide machining with the exception of gun drilling. The cutting fluids normally used in gun drilling also give the longest tool life when carbide drills are employed.

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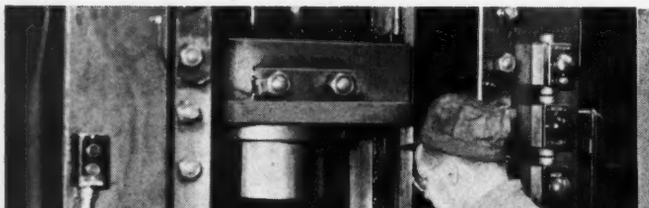
A new catalogue of American Standards, listing 845 standards in the mechanical, electrical, transportation, building, textile, and other fields, has been made available by the American Standards Association, 70 E. 45th St., New York 17, N. Y., and will be sent free of charge to anyone interested.

Cemented Carbides Used for



Cemented Carbides are Generally Thought of as Cutting Tool Materials. Their Hardness and Wear Resistance, However, Make Them Suitable for Many Other Purposes in the Mechanical Industries, Some of which are Briefly Reviewed in This Article

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WHILE cemented carbides are mostly known in the mechanical industries for their metal-cutting characteristics, it is of interest to note that carbides made their initial appearance in Germany as a material for dies used in the drawing of tungsten wire. It was not until later that they came into wide use as cutting tool metals. The applications of carbides in the metal-working field, apart from their use as cutting tools, are today many and varied. They are also used to an ever increasing extent for various purposes in industrial fields removed from metal-working. In the present article, a number of typical and economical carbide applications of a non-cutting-tool character are reviewed. The examples cited may suggest their use for many other purposes.

The Use of Carbides for Wire and Rod Dies

Carbide dies for the drawing of round wire are now generally considered standard equipment throughout the wire industry. The smallest steel wire being drawn through carbide dies at present is believed to be 0.005 inch in diameter. Copper and bronze wire down to 0.062 inch in diameter is being drawn in such dies, and tungsten wire as fine as 0.006 inch is regularly produced with carbide dies. Production records show that carbide dies outlast the formerly used conventional steel dies at least 20 to 1 for ordinary wire drawing. They also insure greater uniformity of product and a better finish.

Bars and rods up to 2 inches in diameter, and even larger, are also being drawn in carbide dies. Tubing—including extremely tough cupro-nickel and aluminum-bronze condenser tubing—is being economically drawn in dies ranging up to 4 1/2 inches in diameter. Steel dies generally have a very short life in this type of service.

Use of Cemented Carbide for Deep-Drawing Dies

Carbon steel, stainless steel, and non-ferrous metals are being deep-drawn in carbide dies that frequently have a life of from twenty to one hundred times that of comparable steel dies. The carbide dies used at present have inside diameters up to 13 1/2 inches; sheet steel up to 3/32 inch thick is being regularly drawn.

The experience of one large producer of high-pressure gas cylinders will indicate the advantages obtained through the use of carbide drawing dies. This company estimates that more than 4,000,000 distinct deep-drawing operations are performed in its plant each year. At present 95 per cent of all the sheet-metal drawing—covering a wide range of thicknesses in a variety of metals—is being performed with Carboloy dies. Neither the operation of the presses nor the lubricant had to be changed when shifting from steel to carbide dies. Some alterations were made in the die size, but no change was necessary in the basic die design.

It is said that the use of carbide dies on a large scale has reduced scrap by 50 per cent in this plant. It has also increased the number of pieces passing inspection by 30 per cent, and it has materially improved the product by eliminating surface de-

Other Purposes than Cutting Tools

fects in the finished drawn parts. Conventional steel dies needed repolishing after an average of 2500 draws. Carbide dies do not require such attention until after performing about 10,000 comparable operations.

In the field of forming also, carbide dies have proved their value. A plant on the West Coast engaged in the manufacture of stainless-steel sleeves for airplane exhaust systems reports the following experience. A stainless-steel blank, 0.063 inch thick and 9 inches in diameter, is cupped and then drawn through three Carboloy dies to produce a sleeve 2 3/8 inches outside diameter. There is no reduction in the wall thickness during the operations. Various types of steel dies were tried, but none produced more than from 500 to 1000 pieces before reconditioning was required. Carbide dies regularly turn out between 5000 and 10,000 sleeves to the required finish and tolerances before they need to be refinished.

The Use of Carbides for Punches and Dies

Carbide punches and dies for stamping, swaging, and sizing comparatively small parts are beginning to be extensively used. In the plant of a manufacturer of calculators and other business machines, carbides in the form of small die inserts of varying shapes are applied for producing large numbers of small parts. For example, in punching holes in small steel hinges, two solid Carboloy pins or cylinders and two Carboloy bushings are employed, as indicated in Fig. 1. The cylinders are mounted in hardened steel punch bodies and fastened in the upper die-block. The bushings are mounted in the lower die-block. Two steel pins are used for lining up the two die-blocks.

With steel punches and dies, the entire die had to be taken down and rebuilt after 25,000 operations. Since the carbide punch and die were installed, several years ago, more than 1,000,000 hinges have been punched. Neither punches nor dies have yet exhibited appreciable signs of wear. It is safe to say that, on an average, the life of carbides used for this purpose is more than forty times that of steel.

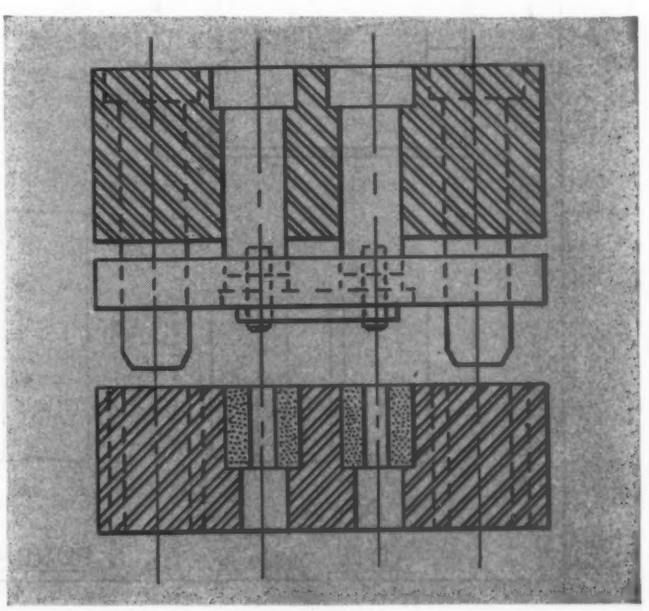
In the manufacture of stator laminations for electric motors, carbide punches and dies are advantageously employed. In one West Coast plant, laminations are punched out from sheet steel containing 0.12 per cent carbon and 2.5 per cent silicon. The annealing of the steel prior to punching produces a scale which, although it has valuable insulating properties, materially increases the abrasiveness of the stock. The carbide dies used for this operation are made in two halves, clamped together, as shown in Fig. 2. This construction permits quick disassembly for sharpening. The carbide punch is concaved on the end toward the center, which tends to draw the cuttings toward the center and thus clear the end of the die.

Regular steel dies and punches produced 46,000 punchings before resharpening. Carboloy punches and dies have produced as many as 2,304,000 pieces between sharpenings. Perhaps even more important in punching stator laminations is the fact that although steel dies invariably left a large burr around the edges of the notches, carbide punches and dies produce laminations entirely free from objectionable burrs. It is said that such burrs, when present, make the laminations difficult to stack and may even cause excessive loss of current in the finished motor.

Cemented Carbide Applications in the Forge Shop and Foundry

Cold-forging with carbide dies has promising possibilities, judging from the results obtained in the cold-nosing of 75-, 90-, and 105-millimeter shells during the war. The application of carbide dies reduced the die cost by 80 per cent. It also reduced maintenance costs and decreased the "down" time of the presses, since the carbide dies

Fig. 1. Solid Carboloy Pins or Cylinders and Bushings Used for Punching Holes in Small Steel Hinges. More Than 1,000,000 Hinges have been Punched without Either the Punches or the Dies Showing Signs of Wear



outlasted similar steel dies forty times. The use of carbide dies did not require any change in the accepted cold-nosing practice, although slightly more care was exercised in lining up the dies as an added protection to the carbide metal. The carbide die showed no tendency to wear or gall.

The wear resisting properties of carbide are also being put to use in foundries. One foundry had trouble with its aluminum core-boxes wearing out too rapidly. These boxes are made in halves and held together by clamps. They are filled with coarse sand and rubbed over a bench top to smooth off the bottom. Since the benches are covered with abrasive coarse sand, the life of the core-boxes averaged only 1500 cores before they either had to be scrapped or completely overhauled. Carbide rings, originally intended for use as fish-rod guide rings, were attached by the foundry to the core-box bottoms, as indicated in Fig. 3. The rings then took the brunt of the wearing action. These wear-proofed boxes produced more than 9000 cores each before any repairs became necessary. The use of rectangular carbide blanks rather than rings would probably be more suitable for this application.

Another foundry where large numbers of aluminum ingots and castings are produced experienced difficulty with the valves employed to regulate the flow of molten aluminum from the ladle. Molten aluminum is so corrosive and erosive that it soon renders useless valves made from either refractories or from conventional metallic alloys. Carbide valves were installed for this purpose. At the latest report they had lasted 150 times as long as the best valves previously available.

Application of Carbides in Machine Tool Construction

There are numerous instances where carbides in the form of ways, pins, and other shapes, have been applied to machine tools to lessen the effect of wear. Cemented-carbide sleeve bearings and ball bearings have also been tried out on an experimental basis. Carbide balls are now being used to support the heavy moving tables on such machines as large planers and grinders. Here both high compressive strength and abrasion resistance are required, since the supporting balls not only carry heavy loads, but are constantly exposed to extreme wear caused by metal dust and chips and the abrasive powder from grinding wheels, thereby destroying the accuracy of the machine. In all cases so far reported, carbide balls have stood up far longer than the hardest steel balls.

Although the use of solid carbide bearings has not yet reached the commercial stage, experimental results have so far been promising. For example, sleeve type bearings made from solid cemented carbide, running against solid cemented carbide, have been installed in place of standard ball bearings in several Dumore toolpost grinders in the Carboloy plant. These Dumore grinders, using diamond

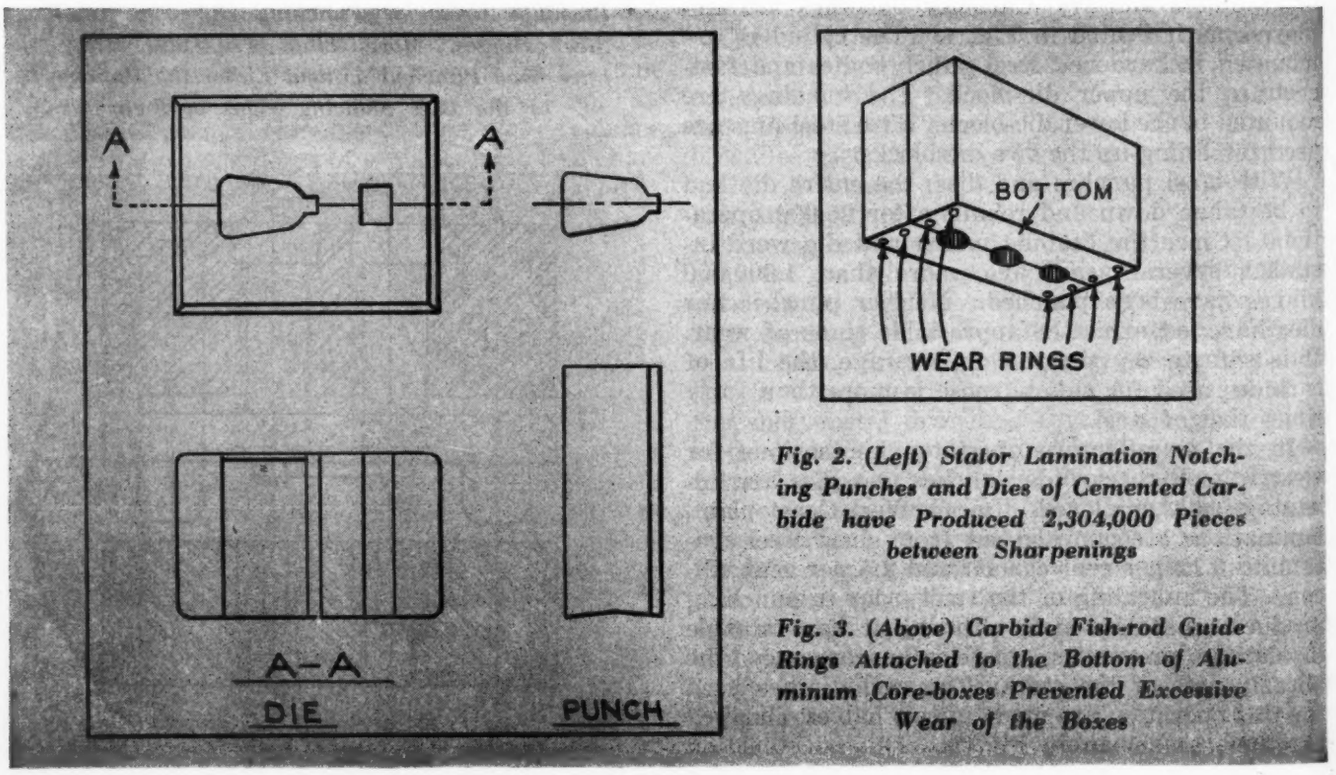


Fig. 2. (Left) Stator Lamination Notching Punches and Dies of Cemented Carbide have Produced 2,304,000 Pieces between Sharpenings

Fig. 3. (Above) Carbide Fish-rod Guide Rings Attached to the Bottom of Aluminum Core-boxes Prevented Excessive Wear of the Boxes

wheels, are employed for grinding the internal and external surfaces of carbide die nibs. The wheel pressures are several times greater than those used with ordinary abrasive wheels for steel grinding. This throws an overload on the standard ball bearings of the Dumore spindle; the overloaded steel ball bearings ran accurately for about a week, and then began to show signs of wear.

An experimental set of Carboloy cemented-carbide combination thrust and radial load sleeve bearings with conical bearing surfaces was made up and installed at each end of the shaft in several Dumore grinders, the inner halves of the bearings being attached to the shaft by Woodruff keys, as indicated in Fig. 4. The conical bearing surfaces take the bearing load, while the cylindrical portions of the bearings may have a running clearance of from 0.0005 to 0.0008 inch. A mixture of kerosene and colloidal graphite is used as a lubricant. These carbide-to-carbide bearings have been in use for more than two years on two eight-hour shifts per day. About 0.000004 inch wear has occurred in that time.

An excellent example of how comparatively small amounts of cemented carbide, correctly applied, can effect over-all savings in a mass production operation is afforded by the use of small carbide pins in place of the ordinary steel pins formerly employed for mounting knurling tools in their holders. This application was made in a plant in the East. This apparently insignificant change virtually eliminated tool maintenance on the knurling operation, and increased the tool life at least 100 times.

In operation, the knurl is mounted on the cross-slide of a lathe, and is forced into the steel work-piece about 1/32 inch. The lathe spindle is started, and the knurling tool is fed 4 inches across the face of the work with an in-feed of 0.024 inch per revolution. This method of starting the knurl requires such high instantaneous pressure that, although the pins formerly were made from drill rod, high-speed steel, and alloy steel, they lasted, on an average, less than a day. The knurl rolls picked up steel from the pins so badly that the rolls jammed, sometimes ruining both tool and work-piece before the machine could be stopped. One operator's full time was required to repair the damaged knurling tools.

When solid Carboloy boring bit blanks were used in place of the steel pins, the trouble disappeared. The first carbide pins installed have run in steady service for more than three months without replacement, the life so far having been over 100 times the best of the previously used alloy-steel pins.

In addition to the applications in the metal-working industry described in the foregoing,

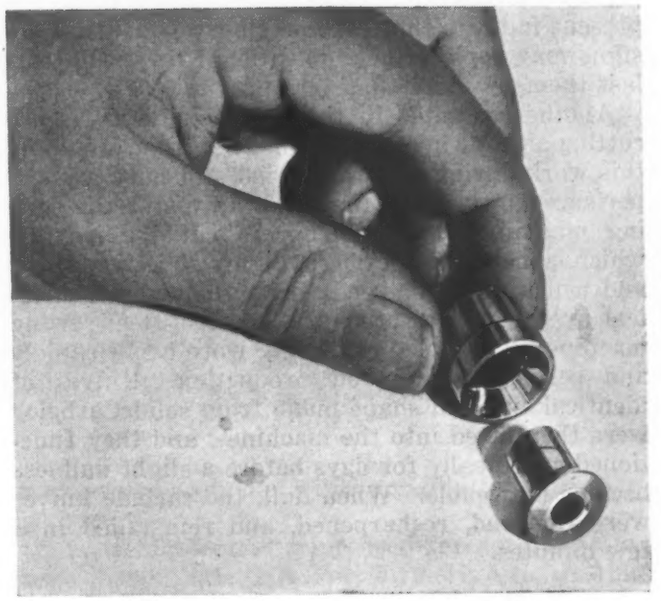


Fig. 4. Experimental Sleeve Type Bearings Made of Solid Cemented Carbide Run against Solid Cemented Carbide. Tested in a Toolpost Grinder, These Bearings have Outlasted Conventional Steel Ball Bearings Many Times

cemented carbides have found extensive use in machine design in industries outside of that field. These applications were somewhat restricted during the war period. Although the output of carbides increased greatly during the war years, while the cost of fabricated carbide products was drastically reduced at the same time, it is only within recent months that cemented carbide has been available in large quantities for more general uses. Its application in the industries in general, however, appear to be fully as great as in the metal-working field, if not greater. In the following are given a number of examples from various fields of industry which will indicate that carbides may be regarded as engineering materials in general, and not only as cutting-tool metals.

Applications in the Textile Industry

One would scarcely expect that the hardest of metals would be used in the manufacture of the soft materials of the textile industry. It is a fact, however, that certain soft materials, when moving rapidly over a surface, produce severe localized wear even on hardened steel parts. This condition is frequently met with in the textile industry. For instance, when rayon thread is passed through guides at a fairly high rate of speed, the guide rings, as originally made from hardened steel or chromium-plated steel, wear rapidly and must be

replaced frequently. Experiments made up to the present indicate that carbide rings of identical designs may replace the conventional rings and outlast them by more than 50 to 1.

Another example in the textile industry is the cutting and sewing of camouflage netting. In doing this work during the war period, difficulty was experienced in keeping the small knives of the sewing machines sharp enough to cut the netting, which is made from a tough, highly abrasive fabric, and which is made even more abrasive by a chemical fireproofing treatment. The tool-steel sewing machine knives used originally wore away rapidly and seriously hampered production. Knives of identical size and shape made from solid Carboloy were then fitted into the machines, and they functioned continually for days before a slight dullness became noticeable. When dull, the carbide knives were removed, resharpened, and reinstalled in a few minutes.

An Application to Office Equipment

Carbides are also finding a place in the manufacture of certain office equipment to guard against the extreme wear caused by another comparatively soft material—paper. In a tabulating machine printer, paper cards have to pass by a so-called "throat block," the function of which is to permit the passage into the machine of only one card at a time. When the throat block has worn 0.003 inch, it admits more than one card at a time, and the operation of the machine must be interrupted until the block has been adjusted sufficiently to compensate for the wear. After a few such adjustments, it is necessary to replace the block. The hardened steel blocks originally used lasted, on an average, about thirty days before replacement. A carbide-tipped block was then tried. When last reported, the Carboloy block had required no adjustment for six months, nor had it shown any detectable signs of wear.

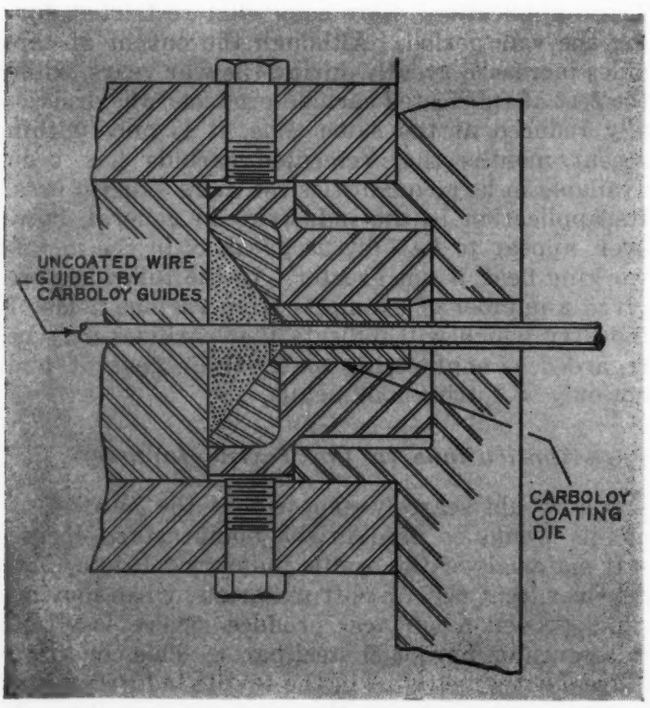


Fig. 5. Carboloy Wire Guides (Not Shown) and Coating Dies are Advantageously Used in the Coating of Welding Rod

Use of Carbides in Manufacturing Coated Welding Rod

Experience indicates that wherever any abrasive material is involved, carbides can be used to advantage to prevent excessive wear. In the manufacture of coated welding rod, for example, a highly abrasive material is used for the coating, which serves as a flux for the molten metal during the welding operation. The coating material is applied to the rod by drawing the rod through a die.

According to a report received from one manufacturer, the original rod guides and coating dies having a Rockwell C 64 hardness lasted for about two weeks under average working conditions. As indicated in Fig. 5, Carboloy guides and dies were installed. At the time of the last report, these carbide parts had been in use twenty-four hours a day for seven weeks, with practically no signs of wear. Based on the first seven weeks' performance, it is estimated that the life of the dies and guides will be something like forty weeks. Continuous production of coated welding rod and greater uniformity of the coating are the two main benefits derived from this application of carbide.

Applications in the Food and Refrigeration Fields

In the dehydration of fruit juices and milk, the erosive and metal corroding liquids are sprayed through nozzles which originally were made of stainless steel, hardened tool steel, or chromium-plated hard brass. The use of carbide metal for the spray nozzles shown in Fig. 6 is said to have increased the life of the nozzles a hundredfold. Contamination of the food is also avoided due to the ability of cemented carbides to resist corrosion. Carbide nozzles are also being used effectively in the medical field in the preparation of blood plasma.

In refrigeration machinery, excessive wear of certain parts may be caused by ordinary operating conditions, added to the erosive effects of such materials as ammonia. One manufacturer claims that

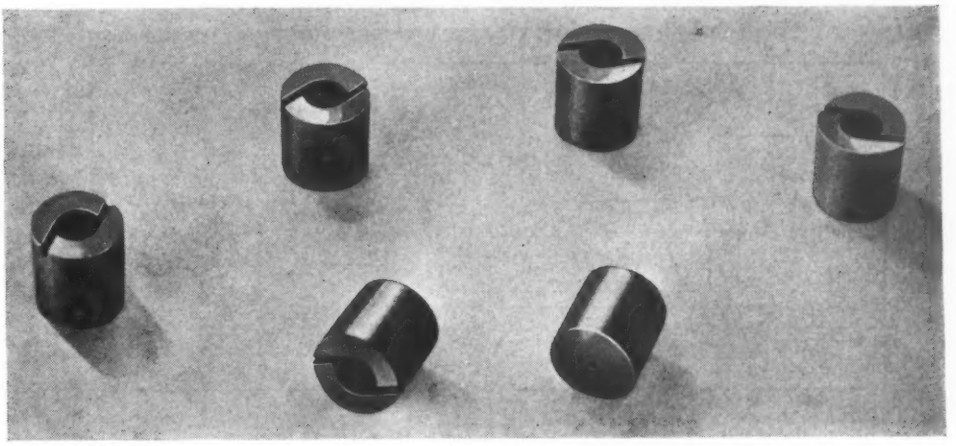


Fig. 6. Carbide Spray Nozzle Inserts for Use in the Food Industries. The Use of Carbide Metal Greatly Reduced Wear of the Nozzles

the life of high-pressure and low-pressure float valves has been increased six times by the use of carbide inserts for the valve seats.

Applications in the Oil and Paint and Telegraph Fields

A combination of wear and erosion caused by the flow of liquids containing abrasive particles has been encountered in hydraulic oil pumps. One such pump was designed to handle 800 barrels of crude oil a day. Since the crude oil contained both sand and water, the wear of the valves was extraordinarily severe. Carbide balls and valve-seat inserts were found to stand up longer than the generally used metals, thus increasing the operating hours per week of the equipment. The ball of the valve is made from solid carbide. The valve seat is generally brazed to the base metal.

The excessive wear of the nozzles used in spray painting, resulting from the erosive action of the pigment particles in the paint continually flowing over the metal surface, has been satisfactorily taken care of by the use of carbides. The carbide nozzles often show a comparative life expectancy over the best conventional types of as much as 50 to 1. They are particularly effective in such work as marking traffic lanes on highways and city streets. The paints best suited for such work contain high amounts of abrasive silica; hence, an abrasion-resistant material is highly important in the nozzles.

A manufacturer of guns used for spraying lacquer reports that the valves formerly used in this equipment lasted a maximum of 800 hours. By replacing the steel valve needles and the nozzles with carbide parts of identical design, the service life of the guns was increased to as long as two years of almost constant twenty-four hours a day operation.

In the telegraph communications field, electrical contacts made of Carboloy are reported to be giving materially better service in modern high-speed telegraph transmission than the formerly used metals such as silver, platinum, and a hard alloy of platinum and iridium. The high speeds at which modern telegraphic apparatus functions make the conventional metals fuse and oxidize. This necessitates cleaning or burnishing the contacts every day to prevent eventual freezing and a subsequent interruption of communications. Solid carbide contacts are self-cleaning, thereby greatly prolonging the active service life of the contacts.

The Use of Carbides on Hand Tools

In many cases, carbides are being applied to a varied line of hand tools in the form of tips, points, edges, etc. This has been found to reduce wear greatly. For instance, wire snips and shears for

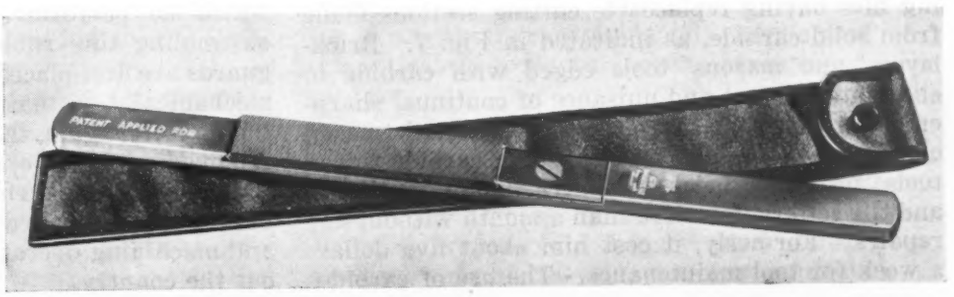


Fig. 7. A File Made with Replaceable Carbide Inserts for Cutting Hard Metals

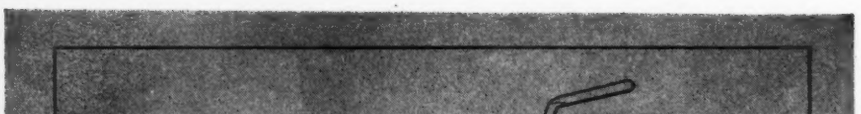


Fig. 8. An Automatic Floor Scraper Made by Mounting Four Carboloy Standard Cutting Tools in a Carrier Ring

cutting soft aluminum sheets with work edges of Carboloy have been in limited use for a number of years with very good results. When handled properly, such tools apparently retain their sharpness indefinitely without servicing.

The conventional type of wire nippers was equipped with carbide inserts by a manufacturing company in the East for use in its own plant. The nippers were employed for the rapid cutting of various sizes of springs made from tempered music wire and ranging in diameter from 0.004 to 1/16 inch. Ordinary steel pliers of the type formerly used for this operation required sharpening after an average of 27,000 cuts—that is, about every other day.

The wire cutters were tipped by the user with four separate carbide inserts set into the jaws, the middle section of each jaw being made from steel. There is about 0.0015 inch clearance between the facing carbide inserts when the jaws are shut. Thus, when cutting wire, the hard carbide inserts never actually touch each other, and damage from the rubbing together of the carbide edges is prevented. As long as seven years ago, some two million cuts had been made with a pair of carbide nippers. No count has been kept since that time, but the same cutters are still in daily use.

Other hand tools in which good use is made of the ability of cemented carbides to resist wear are such different types as paint scrapers and coal-cutters' picks. The latter are tipped with sharp carbide points. The Disston organization is making files having replaceable cutting sections made from solid carbide, as indicated in Fig. 7. Bricklayers' and masons' tools edged with carbide to eliminate the cost and nuisance of continual sharpening are also on the market. One brick mason claims to have used a complete set of carbide-tipped tools, including brick trimmers, hammers, drills, and tile setters, for more than a month without any repairs. Formerly, it cost him about five dollars a week for tool maintenance. The use of carbides for masonry drills is now generally accepted practice.

Carbide can also be applied to the necessary but tiresome job of keeping factory floors clean. At least one company has already availed itself of the abrasion resistance of carbides by devising a mechanical floor scraper with a carbide cutter. This device, illustrated in Fig. 8, is used to automatically remove the extremely abrasive, embedded accumulations of dirt, oil, and chips from the concrete floors in aisles and around machinery. The actual scraping is done by four standard Carboloy lathe tools, mounted at the end of a hand truck. This automatic resurfacer has saved a great many man-hours formerly employed in removing gummy accretions from the floor.

Successful Employment of Blind Veterans

A totally blind war veteran is today performing a creditable job as a machine shop operator in the Buick automobile plant at Flint, Mich. Before the war he was a punch press operator at Buick. He is now operating two machines used in the making of selector control rods for gear-shift mechanisms. In the first operation, he slides a long selector control rod into two slots in a small punch press, which first bends the rod and then punches a hole in it. The material is brought to him while he remains seated before the machine. The second operation, which he performs while standing, consists of assembling tiny rubber guards on the rods. The guards are first placed on a form and then stretched mechanically, so that the rods can be inserted into them. Here, again, the rods are brought to him and removed when the operation is completed.

Blind veterans, when properly instructed, have been found capable of performing both inspection and machining operations in many plants throughout the country.

Speeds, Feeds, and Lubricants for Reaming

A PAPER dealing with the cutting action of reamers was presented before the recent semi-annual meeting of the American Society of Mechanical Engineers in Detroit by T. F. Githens, mechanical engineer of the Cleveland Twist Drill Co., Cleveland, Ohio. This paper was a complete treatise on the design and use of reamers, covering such subjects as point clearance, side clearance or relief, back taper, rake angles, and forms of flutes. It also covered methods of preventing chatter, reamer sharpening, and tolerances. One section of the paper covered speeds, feeds, and lubricants for reamers. The following paragraphs, which are abstracted from Mr. Githens' paper, deal with these subjects.

No definite rules can be given to cover the speeds and feeds that should be used in reaming. Several factors govern the choice of the correct feed and speed. The material to be reamed and the material of the reamer are perhaps the most important factors. The finish desired in the hole and whether hand feed or machine feed is used govern the selection of the proper feed. The type of lubricant used and whether the reamer is piloted or guided in any way also influence the decision.

In general, reamers should be run at about one-half to two-thirds the speed of the corresponding drill. It is best to start the reamer somewhat slower than this and gradually increase the speed until the best condition is found. If the reamer is run at too low a speed, the production will suffer, while if run too fast, the reamer will become dull too soon. Somewhere between these two extremes is the proper speed, which will give a high productivity with a long reamer life.

Feeds should be from two to three times the feed of the corresponding drill. The higher feed causes increased production and reduced tool wear. If too fine a feed is used, the reamer will be subjected to unnecessary wear. Too coarse a feed will produce feed marks in the hole. The desired finish must be balanced against the production per hour.

Feeds are governed by the size of the reamer and the material reamed. A general rule is first to try a feed of 0.002 to 0.004 inch per revolution for reamers smaller than 1/8 inch in diameter; 0.004 to 0.008 inch for reamers 1/8 to 1/4 inch in diameter; 0.008 to 0.014 for reamers 1/4 to 1/2 inch in diameter; 0.014 to 0.030 for reamers 1/2 to 1 inch in diameter; and 0.030 to 0.050 for reamers larger than 1 inch in diameter. Alloy and hard steels should generally be reamed with the lighter feeds, while cast iron, brass, and aluminum are sometimes reamed with the heavier feeds. Suggested speeds for high-speed steel reamers are given in the accompanying table.

Lubricants have many functions, several of which are as follows: (1) To cool both the cutting edges of the tool and the work being machined. This can best be done by directing as large a volume of the coolant as possible on the cutting edges. On thin-walled work it often helps to allow a large volume of coolant to flow on and around the piece. (2) To lubricate the chips; this aids in chip clearance. (3) To improve the finish of the work. The selection and proper application of the lubricant will materially influence the machined finish.

It is suggested that lubrication problems be referred to a reputable manufacturer of cutting oils. The following list of lubricants for reaming holes in different materials should be used as suggestions only:

1. Aluminum and its alloys: Soluble oil; kerosene and lard-oil compounds; light non-viscous neutral oil; kerosene and soluble-oil mixtures.

Suggested Speeds for High-Speed Steel Reamers

Material Reamed	Speed, Feet per Minute
Aluminum and its alloys	130–200
Bakelite	70–100
Brass and bronze, ordinary	130–200
Bronze, high-tensile	50–70
Cast iron, soft	70–100
Cast iron, hard	50–70
Cast iron, chilled	20–30
Malleable Iron	50–60
Magnesium and its alloys	170–300
Monel metal	20–30
Steel, machine (0.2 to 0.3 carbon)	50–70
Steel, annealed (0.4 to 0.5 carbon)	40–50
Steel, tool (1.2 carbon)	30–40
Steel forgings	30–40
Steel, alloy	30–50
Steel, stainless, free-machining	40–50
Steel, stainless, hard	20–30

2. Brass: Dry; soluble oil; kerosene and lard-oil compounds; light non-viscous neutral oil.

3. Copper: Soluble oil; winter-strained lard oil; oleic-acid compounds.

4. Cast iron: Dry, or with a jet of compressed air as a cooling medium.

5. Malleable iron: Soluble oil; non-viscous neutral oil.

6. Monel metal: Soluble oil; sulphurized mineral oil.

7. Steel, ordinary: Soluble oil; sulphurized oil; high extreme-pressure value mineral oil.

8. Steel, very hard and refractory: Soluble oil; sulphurized oil; turpentine.

9. Steel, stainless: Soluble oil; sulphurized mineral oil.

10. Wrought iron: Soluble oil; sulphurized oil; high animal-oil content mineral-oil compound.

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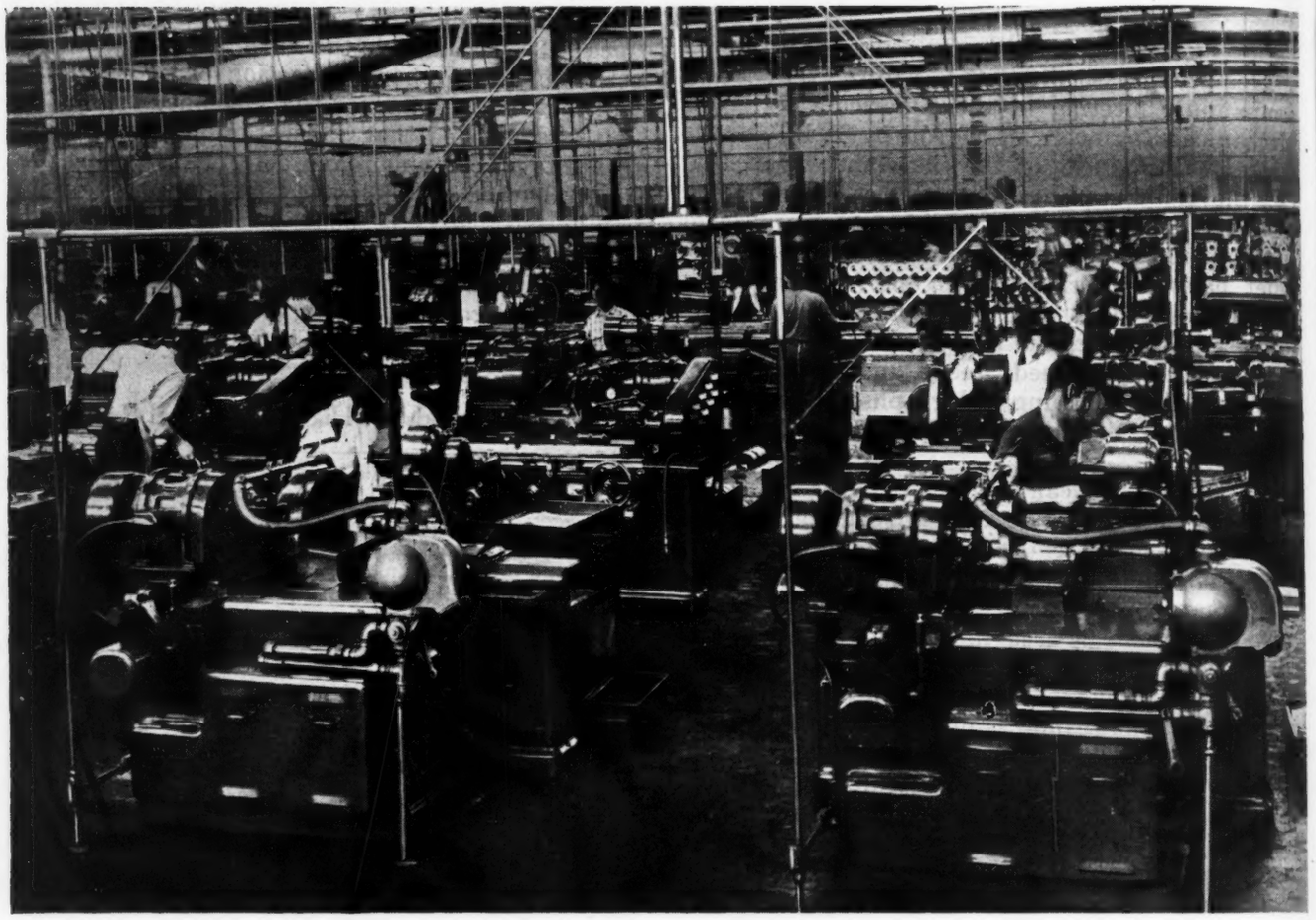
There is real danger that increases in the money wage, brought about by coercion and without regard for productive efficiency, will defeat our objectives of high-level, post-war employment, widely distributed purchasing power, an economy of plenty, and a stable society.—*Louis Ruthenburg*

Hydraulic Oils for Industrial



THE design engineer can choose between mechanical, pneumatic, electrical, hydraulic, or the more recently developed electronic methods of power control and transmission. Each of these methods has a definite field of application in industry. Mechanical and electrical methods are used widely in equipment where it is convenient to locate the source of power and its control close to the work being done. Hydraulic, pneumatic, and electronic controls have the advantage of flexibility in the location of the control equipment; and hydraulic means have the added advantage that the amount of power transmitted is almost unlimited.

Some of the other features of hydraulic power are: (1) Simplicity in design; (2) extreme flexibility of location; (3) adaptability to completely automatic operation to control a sequence of operations; (4) extreme accuracy of control; (5) wide variety of speeds and pressures; (6) reduction of wear on moving parts by (a) resiliency of operation, which minimizes shock loads; (b) automatic release of pressure at overload; (c) absence of vibration; and (7) economical operation.

The development of automatic machines, the desire for labor-saving devices, streamlining, the requirement for remote control, and the need for a compact source of accurately controlled power have all contributed to the interest in hydraulics. Although hydraulics are widely used today, the future is likely to see a still greater diversity of application of this important method of power control.

Obviously, such a diversity of uses for hydraulics necessitates special consideration of the properties of the fluid used. Aircraft, for example. requires the use of special fluids not normally needed by industry. This article is confined to the type of hydraulic oils generally required by industry, particularly for use in metal-working equipment, construction equipment, plastic equipment, marine equipment, and presses.

Principal Types of Hydraulic Systems

Simple hydraulic systems consist essentially of four units—namely, a reservoir to supply oil, a pump to generate flow of the fluid under pressure, a selector valve to direct the flow, and, finally, an actuating cylinder in which fluid pressure is converted to mechanical energy. Such a system may be even further simplified by using a two-way

Equipment

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A Review of the Qualities of Hydraulic Oils, the Difficulties Caused by Oxidation, Rust, Sludge, and Foaming, and How They Can be Overcome, together with Suggestions on Maintenance and the Locating of Troubles in Hydraulic Equipment

variable-delivery pump which eliminates the need of a directional control valve. Systems of this type are used on some hydraulically operated presses, lifts, jacks, and other simple mechanisms, but most systems are much more complex.

The heart of any hydraulic system is its pump; a variety of these are used. Basically, pumps can be classified into two groups: (1) Constant delivery, when running at a given speed, and (2) variable delivery, when running at a given speed.

Constant-delivery pumps operating at a constant speed discharge a constant volume of oil at a given pressure. Systems using such pumps are relatively inexpensive, and usually operate at pressures as low as 200 to 300 pounds per square inch, but seldom higher than 2000 pounds per square inch. Systems incorporating constant-delivery pumps are often used on such machine tools as saws, light surface grinders, and small shapers; they are also employed on lifts, construction machinery, etc.

Variable-delivery pumps are usually run at constant speed, and are so designed that the volume output can be easily varied from zero to maximum in either direction. If suitable valves are incorporated, the operating pressure can also be varied. Such systems are applied where motions must be accurately controlled, where variation in oil flow is great, or where high oil pressures are required. A specific machine may contain either of these types of hydraulic systems, or both may be used on one machine. In some instances, they can be combined into a single system to provide, for example, alternate control during certain portions of the operating cycle.

Pumps may be further divided into groups based upon the method used to create pressure. Practically all hydraulic pumps fall within three classifications of design—namely, gear, vane, and piston types. All three types can be used in constant-volume systems, whereas only vane and piston pumps are applicable in variable-volume hydraulic systems.

Hydraulic pumps and valves are precision instruments in every sense of the word. Careful selection of metals and fine workmanship are necessary requirements in the production of pumps and valves capable of generating and controlling the pressures encountered in hydraulic systems. The efficiency of a hydraulic pump depends upon the absence of wear throughout its life. Abnormal wear causes increased slippage of the oil, resulting in power loss, reduced output, and increased operating temperature.

Clearances in pumps are extremely small, and even small amounts of gum or sludge from the oil, or contaminants such as rust or dust, can cause trouble, just as in a ball or roller bearing. The flow-control, metering, sequence, pressure reducing, and other types of valves used in controlling the flow of oil from the pump to the actuating cylinders are also made with very close tolerances to give precision control. These, too, must be protected from abnormal wear and the presence of contaminants.

Hydraulic equipment manufacturers have done an excellent job in developing systems that will give trouble-free operation over long periods of time, but even the best of equipment will not continue to function properly if the fluid used in the system is not of proper quality and correct grade. Petroleum refiners have met this challenge by developing oils specifically designed for use in hydraulic systems.

Many factors dictate the need of special care in selecting hydraulic oils. Some of the factors encountered in hydraulic systems such as rusting, contamination, etc., have necessitated the development of oils having certain properties which result in the elimination, or at least minimizing, of the adverse effects these factors have on the continued smooth operation of the hydraulic system. Some of the more important factors that can cause erratic action of hydraulically operated equipment, or even complete stoppage, are discussed in the following paragraphs.

Gum or Sludge Formed as the Result of Oxidation

Oil in hydraulic systems is subjected to violent agitation each time it passes through pump and valve mechanisms; and in cases where reservoirs on equipment are comparatively small, the lubricant does not have much chance to rest between cycles. Continued severe agitation contributes to oil oxidation.

Temperature, too, is a contributing factor to oxidation. For example, it is known that, if all other factors remain constant, rates of reactions will double for every 18 degrees F. increase in temperature. Below about 140 degrees F., the rate of oxidation of oil is very slow, if pressure, agita-

tion and catalysts are not contributing factors. Above this temperature, the rate of oxidation increases so much that it becomes an important factor in the life of the oil, and for this reason it is desirable that hydraulic systems operate at as low an over-all temperature as is practicable. The average temperature of oil in a hydraulic system is not a true indication of the highest temperature to be found. In the pump, for example, changes in pressure from atmospheric to several thousands of pounds cause momentary heating of the oil to a very high temperature.

A third factor affecting oil oxidation is pressure. As the pressure is raised, there is a mild increase in oxidation rate. Also, as the pressure is increased, the rate at which the oil passes through small clearances is increased, thus causing a more severe "shearing action" of the oil. This, too, is conducive to oxidation. Oxidation of oil is also catalyzed by metals, such as copper, bronze, brass, and steel, as well as by water, dust, rust, and other contaminants.

Each of the factors mentioned—agitation, temperature, pressure, and catalysts—when present, exerts its individual effect on the deterioration of oil. When all are present, as they are in most hydraulic systems, the cumulative effect may be sufficient to cause serious oxidation of oils. Manufacturers of hydraulic equipment and oil suppliers, alike, recommend, therefore, *that only oils highly resistant to oxidation be used.*

If oils highly resistant to oxidation are used and accepted maintenance practices are followed in the care of the oil, oxidation will seldom, if ever, occur to the extent that gumming or sludging will take place. In some instances, where oils of poor quality have been used or where abnormal operating conditions were encountered, oxidation of the oil proceeded so rapidly that sludging necessitated a shut-down of the systems after only a week or two of operation. Obviously, systems so sludged up must be completely dismantled and mechanically cleaned —an expensive process, particularly when the non-productive "down" time of the machine is taken into account.

Oxidation to be harmful need not proceed to the stage where sludge is formed. A small quantity of gummy material, for example, may cause the sticking of closely fitted parts in the pump and valves. Small amounts of sludge or gum can easily plug the orifices in various valves and pumps. If these are plugged, the action of the entire system becomes erratic, necessitating a shut-down.

Oxidation of oils in hydraulic systems can be minimized by three methods: (1) Use of oils which are so refined that they are resistant to oxidation, and which are, in addition, inhibited against oxidation by the incorporation of certain additives. (2) Use of systems in which one or more of the factors contributing to oxidation are minimized. (3) Proper maintenance (including established drain periods), cleanliness, and prevention of contaminants entering the system.

Rust Caused by Moisture Can be Counteracted

Undoubtedly, more equipment made of ferrous metals is destroyed by rust than by any other single factor. Hydraulic systems are no exception. Rusting occurs in a hydraulic system because moisture is present, due to condensation from air entering through leaks on the intake side of the pumps, breathing of air through vents in reservoirs, contamination, etc. Such rust may not look serious, but only one or two flakes of rust passing through precision-made pumps and valves can so scratch the surfaces that the efficiency of these parts is reduced. Pumps operating at extremely high pressures should be carefully protected against rust, as a scratch on the pistons, for example, may permit an excessive amount of slippage.

The petroleum chemist has offered a means of preventing rust formation by incorporating suitable inhibitors which "plate out" on metal parts, keeping moisture away from the surface. This is a far more practical means for rust control than complete elimination of all moisture from the system—an expensive and unreliable procedure.

Contamination in Hydraulic Systems

Hydraulic systems, though supposedly tightly closed and built to operate at high pressures, are not always immune to contamination in operation. Also, impurities get into systems while repairs are being made, if extreme care is not exercised. Many kinds of contaminants may cause deposit formation in a system. Some of these are cutting oils and coolants leaking into the system; grease finding ingress through packing glands or on piston-rods; atmospheric dust through the breather; surface paints which are not resistant to hot oil; indiscriminately used rustproofing preparations, gasket cements, and pipe sealers, to mention only the more commonly encountered causes.

The petroleum chemist has done his best to furnish oils resistant to contaminants by giving them an exceptionally high chemical stability. The only cure, of course, is proper maintenance, so that contaminants do not enter the hydraulic system.

Of the detrimental factors mentioned, gumming or sludging and rusting can be prevented or minimized by the incorporation of certain additives in the oil. However, in developing a good hydraulic oil, many other desirable characteristics must be considered as well.

Desirable Properties of Hydraulic Oils

The hydraulic systems of years ago were designed to operate with water, and, in some respects, that is an ideal hydraulic fluid. Water, however, has three primary disadvantages; namely, it freezes at a temperature above that often encountered in hydraulic installations; it accelerates corrosion of metal parts; and it furnishes practically no lubrication to the moving parts of pumps or controls. These disadvantages led to the use of petro-

leum oils because of their availability, adaptability, and reasonable cost. The principal advantage of oil is that it not only serves as a fluid for power transmission, but also lubricates moving surfaces.

With the advent of improved hydraulic systems, operating continuously for long periods and at high pressures, even premium-grade straight mineral oils were found to be lacking in resistance to oxidation, protective ability, and foaming. These undesirable characteristics of straight mineral oils were overcome after extensive research by the use of additives.

The development of the inhibited type of hydraulic oils in use today did not occur over night. It began in the research laboratory. Here, petroleum chemists studied literally thousands of potential additives. The more promising of these were subjected to severe laboratory tests, and those passing these tests were then subjected to tests in hydraulic equipment. From the inception of the idea to the development of the final product was a long and arduous process. However, only through such a procedure was the ultimate in hydraulic oils developed. In order to explain the importance of the various properties of hydraulic oils, a short discussion, starting with the base oil, follows:

Base Oils Used in the Manufacture of Hydraulic Fluids

Base oils used in the manufacture of hydraulic fluids are carefully distilled fractions of selected crude oils. These fractions are refined by the best processes known to petroleum refiners, for the purpose of removing undesirable constituents. The resultant oil is comparable in quality to that used for the lubrication of steam turbines. This base oil is then fortified with various added inhibitors.

Additives have a remarkable effect on the life and other properties of hydraulic oils, as is shown by the examples quoted below. Their presence, however, does not permit the use of inferior base oils if best results are desired. For this reason, all satisfactory hydraulic oils on the market today use base oils refined to a very high degree.

Oxidation Stability of Inhibited Hydraulic Oils

The theory underlying the effectiveness of oxidation inhibitors may be explained briefly as follows: (1) Oxygen, which is present in the oil as a result of aeration, reacts with the oil through a "chain reaction" to form undesirable sludge and acidic material. (2) In the presence of metals and water, this reaction with oxygen is accelerated or catalyzed. (3) Certain chemicals, when added to the oil, slow down oxidation by reacting with the oxygen and breaking the chain reaction, and also by deactivating the metal catalysts.

A great deal of time and effort has been spent in trying to develop suitable laboratory oxidation tests which will predict the stability of oils against oxidation in actual service. Numerous tests of this kind have been devised and many have been discarded as impractical or because they definitely cannot be correlated with actual field experience.

Effectiveness of Oxidation Inhibitors

Application in a Machine Production Shop

In a machine production shop in Chicago, changing from a turbine-grade straight mineral oil to an inhibited oil resulted in lengthening the time between drain periods 100 per cent. With the straight mineral oil, it was necessary to dismantle the machine tools every three or four months to clean the hydraulic systems. After eight months' operation with an inhibited oil, not a single machine had to be cleaned, and one machine that had been stopped for mechanical repairs was found to be in exceptionally good condition and free from sludge or varnish.

A Case Involving Milling Machines

An automobile accessory manufacturer in Chicago was experiencing considerable trouble with a varnish-like product settling out of the well refined straight mineral hydraulic oil he was using in ten milling machines. Drain periods were frequent, and often the hydraulic systems had to be dismantled for cleaning. Since the introduction of an inhibited hydraulic oil, the drain period intervals are three times as long, and there have been no deposits of any kind from the oil.

Inhibited Oils in a Machine Tool Plant

A machine tool manufacturer found, when operating one of his machines continuously—day in and day out—with a turbine-grade mineral oil, that sludging of the hydraulic system resulted after from 500 to 700 hours of operation. By changing to an inhibited type hydraulic oil, he was able to increase the time between drain periods to 2400 hours, with no indication of gum, varnish, or sludge formation.

Grinding and Broaching Applications

An eastern manufacturer of grinders found that straight mineral oils should be changed every three months. Tests on an inhibited type hydraulic oil showed that the interval between drain periods could be extended for one year.

The hydraulic system of one broaching machine, operating twenty-two hours a day continuously, had to be dismantled every two weeks to clean rust and deposits from pistons and valves, in order to get the machine to run smoothly and with the proper speed. After switching to an inhibited type hydraulic oil, the same machine ran for ninety days between drain periods, with no indication of trouble.

Today, the most generally accepted laboratory oxidation test for hydraulic oils is one proposed to the American Society for Testing Materials, known as the ASTM oxidation test. This test has not yet been accepted as a standard procedure by the Society, because correlation with performance in the field has not yet been established.

In the ASTM oxidation test, the oil is oxidized at 203 to 205 degrees F. with pure oxygen in the presence of water and a copper-iron catalyst. The life of the oil is arbitrarily taken as the time required for the neutralization number (a measure of the organic acidity developed through oxidation of the oil) to reach a value of 2.0. Oils considered satisfactory by this severe test should not exceed a neutralization number of 2.0 after 1000 or more hours.

In this severe, accelerated oxidation test, well refined straight mineral oils normally take about 75 hours to reach a neutralization number of 2.0. The number of hours, however, will become greater, depending upon the efficiency of the inhibitor added. Values of 1500 or more hours are not uncommon with oils containing oxidation inhibitors proved in service to be very effective.

Results obtained by the ASTM oxidation test indicate that oils containing additives to inhibit oxidation will give much longer service than straight mineral oils, and this has been substantiated by field experience. Just how much longer service can be obtained in actual installations will depend upon the equipment itself, for many other factors determine the actual life of a hydraulic oil.

There are literally hundreds of agents which can be added to oils to improve their oxidation stability, some of which are far more efficient than others. The ASTM oxidation test is a valuable research tool in weeding out the poorer of these, but the only known way of proving which inhibitor is best is to run tests in actual or simulated hydraulic systems. Therefore, in selecting an inhibited type oil, the best procedure is to choose one which has been proved in service to be highly resistant to oxidation.

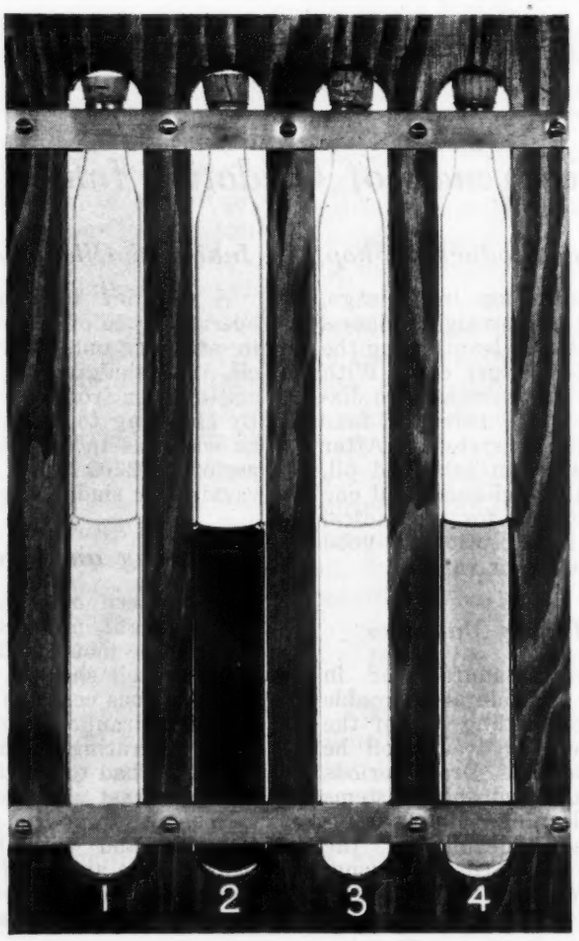


Fig. 1. ASTM Oxidation Tests with New and Oxidized Hydraulic Oils. 1. New Straight Mineral Hydraulic Oil. 2. Same Oil after Seventy-two Hours. The Neutralization of Straight Mineral Oil at This Stage Reached the Maximum Allowable Number (2.0). 3. New Inhibited Hydraulic Oil. 4. Inhibited Hydraulic Oil after One Thousand Hours. The Neutralization Number was 1.0

Rust Prevention in Hydraulic Systems

While many theories have been advanced to explain the action of rust inhibitors, the most plausible is that the inhibitor which has been added to the hydraulic oil "plates out" on the metal surfaces, forming an oily film which is impervious to the rusting action of moisture and air.

Actually, the amount of rust inhibitor in the oil is only a fraction of 1 per cent, yet such a small amount has been proved to be sufficient to protect all metal surfaces in a hydraulic system against rust formation. No attempt has been made to measure the thickness of the protective layer formed, but it cannot be more than a few molecules thick.

The generally accepted method for testing the effectiveness of rust inhibitors in the laboratory is the ASTM rusting test. Carefully prepared steel rods are suspended in a mixture of the oil under test containing 10 per cent water, which is agitated rapidly for forty-eight hours at a temperature of 140 degrees F. In order for the oil to be considered satisfactory, the rods must show no rusting at the end of the test.

The effectiveness of one rust inhibitor, as shown by the results obtained in this very severe test, is illustrated by Fig. 2. When an uninhibited straight mineral oil was used, the rod rusted badly, but when a rust inhibitor was incorporated in the oil, the rod did not rust. This inhibitor has been proved in service to be extremely effective in the prevention of rust in hydraulic systems.

The fact that the protective film furnished by such an additive has great durability is shown by another laboratory test, the Shell film tenacity test. In this test, a metal rod, which has shown no sign of rusting at the conclusion of the ASTM rusting test, is placed in a beaker containing water only. The

water is agitated continuously for twenty-four hours at 140 degrees F.; to pass the test, the rod must show no sign of rusting. The significance of this test is that, once the metal parts of a hydraulic system, whether submerged in oil or not, are coated with the inhibitor, they are impervious to water from condensation or contamination.

This protective film, on the other hand, can be removed by any mineral oil that is not rust inhibited, since, apparently, an equilibrium is set up between the amount of inhibitor plated out and that in the oil. For this reason, if a straight mineral oil is used for "make-up" after an initial charge of rust-inhibited oil, the effectiveness of the rust inhibitor will be lost, as the "plated out" inhibitor will gradually go back into the "make-up" oil.

Protection against rust is important even in systems where leakage is a factor. In such systems, it has usually been thought that general machine oils could be used, because the oil was replaced so fast that it did not have a chance to oxidize much. Experience proves, however, that it is economical to use rust-inhibited oils in systems of this type.

Oils containing rust inhibitors are effective in protecting pumps and parts during storage.

Foaming of Straight Mineral Oils

Straight mineral oils are more or less susceptible to foaming, but petroleum technologists have found a way to so refine and treat hydraulic oils that if air does get into the system, it will separate quickly from the oil and can be vented off.

All mineral oils will absorb a certain amount of air, depending upon the temperatures and pressures involved. For example, at atmospheric pressure and at 77 degrees F., one gallon of oil will absorb about 10 per cent of air by volume, but at 200 pounds per square inch gage pressure and at 77 degrees F., one gallon of oil will absorb about fourteen times this amount of air (as measured at atmospheric pressure). As the pressure is raised, more air can be absorbed.

So long as the air is in solution, no harm will result, but if the pressure is reduced, the air in the oil comes out of solution and the result is foaming, if the oil is not such that it will separate quickly from the air.

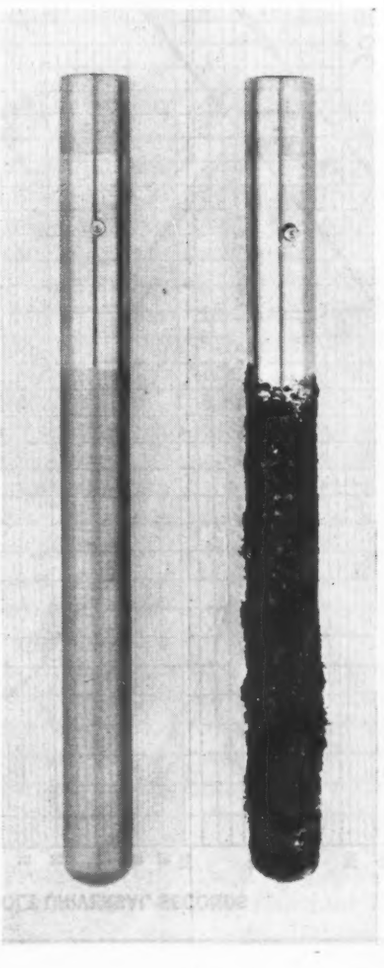


Fig. 2. ASTM Rusting Test Specimens, Using Distilled Water. The Strip at the Left was Coated with an Inhibited Hydraulic Oil; the Strip at the Right was Coated with a Straight Mineral Oil

Foam or free air in the system is compressible, resulting in chattering or irregular motion of the moving parts. If the air separates quickly from the oil, the troubles can be remedied temporarily by venting off the free air. Foam, on the other hand, is an emulsion of air and oil, and cannot be vented off satisfactorily.

Air leaks are due entirely to mechanical causes, such as leakage in the oil-pump suction line; low oil level in the reservoir, permitting the pump suction inlet to become exposed; leakage around packings, etc. It is important that the cause of air ingress be found and corrected immediately, not only because air in the system may result in erratic motion of moving parts, but for another very good reason. As mentioned before, air is compressible, and as air is compressed it becomes extremely hot.

For example, if air is quickly compressed to 100 pounds per square inch, the theoretical temperature of the air would be 485 degrees F.; at 3000 pounds per square inch, it would be 2020 degrees F. In a hydraulic system, if air bubbles or free air were compressed from atmospheric pressure to these pressures, the resultant temperatures would be somewhat lower, depending upon the rate of compression, absorption into the oil, heat lost through conduction, etc.; but obviously, the temperature would be sufficiently high to scorch the surrounding oil, with the result that oxidation of the oil would take place. Even though the heat thus generated may not be sufficient to be noticed in the overall temperature of the oil, continued oxidation of this type is cumulative and will eventually cause the entire batch of oil to become oxidized.

Viscosity of Oils for Hydraulic Systems

Viscosity is undoubtedly one of the most important factors to be considered in the choice of a suitable hydraulic oil. To meet the demands of various types of hydraulic pumps, quite a number of grades of hydraulic oil are available. Each hydraulic pump, because of its design features, operates at its highest efficiency on an oil of a given viscosity. It is for this reason that hydraulic pump manufacturers issue specifications stating a limited range of viscosities for the oils to be used in their pumps. These viscosity specifications should be adhered to in selecting a suitable oil.

The reasons why so much importance is attached to the viscosity of oils in hydraulic sys-

A.S.T.M. STANDARD VISCOSITY-TEMPERATURE CHARTS
FOR LIQUID PETROLEUM PRODUCTS (D 341)
CHART B: SAYBOLT UNIVERSAL VISCOSITY, ABRIDGED
FIG. 3
EFFECT OF TEMPERATURE
ON VISCOSITY
VISCOSITY, SAYBOLT UNIVERSAL SECONDS
TEMPERATURE, DEGREES FAHRENHEIT
300 S.S.U. Visc. at 100° F.
150 S.S.U. Visc. at 100° F.
90 Viscosity Index
50 Viscosity Index
90 Viscosity Index
50 Viscosity Index
A
B
C
D

tems are of considerable interest. Of paramount importance is the fact that the viscosity must be sufficiently high to prevent wear. Practically all modern pumps will operate without excessive wear when a relatively light oil is used, but usually an oil of higher viscosity must be employed because of other reasons.

In all pumps, there is a certain amount of slippage, or internal leakage of oil—that is, oil is not displaced 100 per cent by the vanes, gears, or pistons in the pumps. As the viscosity of the oil is raised, slippage will be reduced because of the increased film thickness of the oil. In badly worn pumps or pumps manufactured with relatively large clearances, it is necessary to use an oil having a fairly high viscosity.

In variable-displacement piston pumps, slippage can be compensated for by lengthening the stroke of the pistons. In constant-delivery pumps working against a by-pass relief valve which controls the discharge pressure, the volume of oil discharged is always greater than the amount used in the system. Increased slippage in these pumps merely reduces the amount of oil going through the by-pass valve. As slippage is increased, however, the temperature of the oil is also increased, which is detrimental from an oxidation standpoint. If an oil having too high a viscosity is used, the oil does not flow readily. In addition, the pressure drop through the system increases with greater viscosity, which, in turn, reduces the efficiency of the system and increases the power consumed in the pump.

Thus it can be seen that the choice of an oil of suitable viscosity depends, on the one hand, on choosing a viscosity sufficiently high to reduce wear and minimize slippage or leakage; and on the other hand, on choosing a viscosity low enough so that the oil will flow readily through the system, thus affording quick response of the moving parts and keeping the power consumption at a minimum.

Effect of Temperature on Viscosity

So far the discussion of viscosity has been confined to a more or less normal temperature of pump operation. Since the viscosity of oils is affected by temperature, it is important that, in choosing a suitable hydraulic oil, careful consideration be given to the temperature range over which the hydraulic system will operate. At very low ambient temperatures, even oils having a low viscosity at 100 degrees F. will have a comparatively high viscosity, as illustrated in Fig. 3. This chart is so designed that the viscosities of a given oil at 100 degrees F. and 210 degrees F. can be plotted and a straight line drawn through these points. From this line then can be read the viscosity of the oil at any given temperature.

From this chart, it can be seen that an oil having a viscosity of 150 seconds at 100 degrees F. (and a viscosity index of 90) would have a viscosity of about 8000 seconds at 0 degree F. The latter viscosity would be the viscosity of the oil in a hydraulic system starting up at 0 degree F., but, of course, as the oil becomes heated during operation, its viscosity is correspondingly changed.

Several hydraulic pump manufacturers state, in their oil specifications, that the viscosity of an oil should never exceed 4000 seconds at the lowest starting temperature. The reason for such a specification is that if an oil has a higher viscosity, it will not flow readily to the pump, and will be too viscous to permit quick response of the moving parts. Thus, if equipment, such as construction machinery, is to be operated at a very low ambient temperature, it is necessary to use an oil having a low viscosity at 100 degrees F., or to incorporate suitable heaters to raise the temperature of the oil.

Fig. 3 illustrates another point often brought up in discussing hydraulic oils—namely, viscosity index. The viscosity index is a numerical means of expressing the slope of lines drawn on a chart such as the one illustrated. A high viscosity index signifies that changes in temperature will result in a lesser change of the viscosity of the oil than that which occurs in an oil with a low viscosity index.

For example, Fig. 3 involves four oils, two having a viscosity index of 50, and the other two having a viscosity index of 90; but for simplicity, consider only the two oils having a viscosity at 100 degrees F. of 150 seconds Saybolt universal (S.U.S.) (Lines *A* and *B*). Line *A*, representing an oil having a viscosity index of 50, has a viscosity of 4000 seconds at about 18 degrees F. (See point *C*), whereas line *B*, representing an oil having a viscosity index of 90, has a viscosity of 4000 seconds at approximately 12 degrees F. (see point *D*). Thus, an improvement in viscosity index of 40 points results in a lowering of the minimum operating temperature of only 6 degrees F., and in each case, the maximum viscosity does not exceed 4000 seconds.

Oils having a high viscosity index are desirable because, obviously, such oils will permit easier starting at low temperatures and shorter warm-up time. Conversely, they will afford better protection to moving surfaces at high operating temperatures. Mineral oils can be refined to have viscosity indexes in the range of 80 to 100 without increasing the cost greatly, and most industrial hydraulic oils on the market today fall within this range.

The viscosity index of an oil can also be increased by the use of additives termed "viscosity index improvers." Materials used up to the present are generally polymers or long-chain hydrocarbons, which, it is understood, tend to break down after use at high rates of shear or under severe agitation. Additives of this type have been used in oils in hydraulic equipment exposed to much wider temperature ranges than are usually encountered in industry, such as in aircraft. Undoubtedly, they will find some additional use in unusual hydraulic applications subjected to wide temperature variations, but normally they are not employed exten-

sively as yet because of their tendency to break down in severe service, and also because of their high cost.

Pour Point and its Significance

The pour point of an oil is defined as the temperature at which an oil ceases to pour under certain standard conditions. All modern hydraulic oils for industrial uses have sufficiently low pour points to be fluid when used in systems located indoors and not exposed to abnormally low temperatures. In systems operating out-of-doors, where ambient temperatures may be very low, the pour point of the oil must be safely below the lowest temperature encountered. If it is not, wax may start to precipitate and obstruct small orifices or interfere with the smooth operation of moving parts.

It must be remembered that, although a specific oil has a pour point well below a given low ambient temperature, this does not mean that it is satisfactory for use. The same oil may have a viscosity at that temperature well above the maximum for many pump applications, and, therefore, will not feed properly to the pump or through the system.

Maintenance of Hydraulic Equipment

The use of oils inhibited against oxidation will greatly increase the interval between draining periods, provided contamination from outside the system is not a serious factor. Therefore, in order to obtain maximum use from a hydraulic oil, definite draining schedules should be established. Since many factors affect the life of an oil, each machine should be checked separately to determine its draining period.

System Cleaning at Regular Intervals

Systems that accumulate sufficient deposits to interfere with the operation of the machine can be divided into two classes—those that can be flushed with light mineral oils, and those requiring more drastic action. If a light oil can be used, the type of oil and flushing procedure must be selected to suit local conditions. Flushing oil containing a rust inhibitor is particularly advantageous, because it protects metal surfaces against rust formation after draining out the hot flushing oil.

Systems sludged up sufficiently so that they cannot be cleaned with a flushing oil should be dismantled and cleaned mechanically. Solvents and chemical cleaners on the market today are not recommended for use in hydraulic systems for several reasons. Among these is the fact that some do not offer sufficient lubricating value, with the result that moving parts are damaged. A second reason is that it is very difficult to remove all the solvent or cleaner from the system and any remaining deposits will dilute the fresh hydraulic oil and form gummy deposits on difficult emulsions.

If rags are used to clean out the inside of a system, they should be clean and lint-free. The use of waste or unsuitable rags which may leave threads or lint sticking to closely fitted moving parts should be avoided.

Oil Temperature Should be Watched

The temperature of the oil in a hydraulic system should be kept below about 140 degrees F., if possible, or a lower temperature if so specified by the manufacturer. There are two very good reasons for this. At temperatures above 140 degrees F., the rate of oxidation of all oils (less with those inhibited against oxidation) becomes appreciable, and rises rapidly as the temperature increases. In addition, as the temperatures increase, the viscosity of the oil is reduced, and if reduced sufficiently, excessive slippage will occur.

The Data Sheet (page 245) accompanying this number of MACHINERY deals with "trouble shooting" in hydraulically operated systems.

Concluding Remarks

Hydraulic equipment manufacturers are constantly seeking ways of making improvements, both in the design of their systems and in the ever increasing scope of their application. Constant efforts are being made to improve the metals and alloys used in hydraulic equipment, to reduce the over-all size of pumps, valves, and lines, and, generally, to produce systems that are more versatile and efficient.

The field of application for hydraulic power is constantly being broadened. Hydraulic power is being used today in installations where the use of such a system was thought impractical only a few years ago. Examples of these are braiding or knitting machines, conveyors, bottling and filling machines, pulp grinders, centrifugals, reels and coiling machines, paper and rubber pressing machinery, printing presses, stokers, dry cleaning machines, agitators, and many others.

Each new development requires careful consideration of the properties of the hydraulic oils used. A few may require the use of special oils. For example, hydraulic controls are widely used in coal-mining and die-casting equipment. In these industries, consideration must be given to the possibility of fires, and, as a result, work is now being carried out to develop fire-resistant hydraulic fluids; but the synthetic, non-inflammable fluids developed up to the present time have been considered by some to be too expensive for general use.

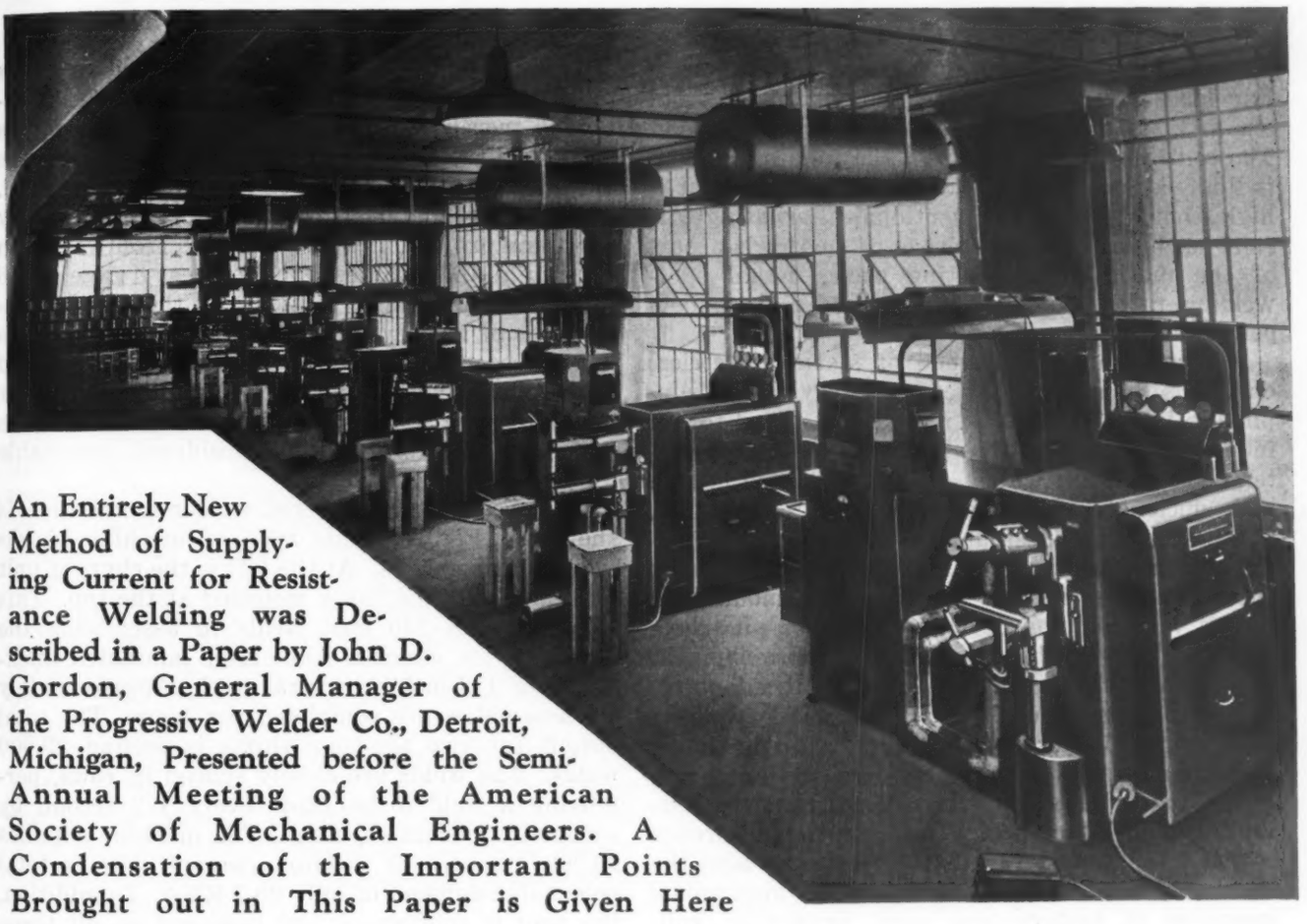
* * *

Gearing Industry Reports Increased Sales

The gearing industry, as represented by members of the American Gear Manufacturers Association, reports an increase in volume of sales for May, 1946, of 10 per cent, compared with April, 1946. These figures do not include turbine or propulsion gearing. The index figure for May, 1946, was 313.

Resistance Welding with Storage-Battery Power

A New Development in Electric Welding



An Entirely New Method of Supplying Current for Resistance Welding was Described in a Paper by John D. Gordon, General Manager of the Progressive Welder Co., Detroit, Michigan, Presented before the Semi-Annual Meeting of the American Society of Mechanical Engineers. A Condensation of the Important Points Brought out in This Paper is Given Here

RESISTANCE welding has been widely adopted for the mass production of assemblies in practically every industry employing steel fabrication. Recently, the increased demand for high-production welding equipment has led to the development of storage-battery powered resistance welders, which overcome the inherent limitations of conventional welding processes, especially when applied to aluminum and its alloys.

A simple spot weld is made by passing a heavy electrical current through metal parts while they are held in intimate contact. The heat for the formation of the weld nugget is generated by the resistance of the metal to the flow of electrical current. The intensity of the current must be sufficient to fuse the nugget before the heat is conducted away by the surrounding metal. Since aluminum is a good conductor of both electricity and heat, it is difficult to spot-weld, compared to steel, requiring very high welding currents of relatively short duration.

It is possible to weld aluminum and its alloys with conventional alternating-current resistance welders, modified to deliver welding currents of 10,000 to 30,000 amperes. However, the power line demands of such machines are exceedingly high, and they operate at a very low power factor. A typical alternating-current aluminum welder has a demand of about 400 KVA at 40 per cent power factor, lagging. It is not often that power supply is available for equipment in this power demand range. The operation of such machines is costly, and the investment necessary to provide heavy-duty power lines from the machine to the source of supply is often prohibitive.

Storage-Battery Power for Welding

"Stored energy" types of welding machines offer a solution. Energy can be supplied to machines at a low rate, stored, and then delivered at a high rate for welding. Two types of "stored energy" machines have been developed. One type makes use of direct current to build up an intense magnetic field in a specially designed transformer. When the current is interrupted, the rapid collapse

of the magnetic field momentarily induces a high current value in the welding circuit to produce a weld. The other type of machine converts line power to a high direct-current potential for charging a bank of condensers. The discharge of these condensers through a transformer into the welding circuit produces the weld.

Both types of machines can be operated on three-phase supply, with consequent reduction in power-line loads. Their power demand averages about one-fifth that of the alternating-current welder. The control of the duration of the welding current is limited, and the initial cost of this equipment is high, compared with conventional alternating-current machines. As the storage of energy is a part of the machines's operating cycle, actual spot-welding rates usually do not exceed eighty spots per minute.

The most obvious method of storing electrical energy is the storage battery. Energy can be supplied to it continuously at a low rate, stored for an indefinite period, and used as required. Unit battery chargers are widely available. These have a high efficiency and are simple to operate. However, the problem of interrupting the enormous low-voltage direct currents that are required in resistance welding seemed at one time insurmountable. Now a very common device—the carbon-pile rheostat—has solved this problem. The development of a form of this laboratory instrument, adaptable to routine resistance welding, has made welding with storage-battery power practical in industry.

Storage-battery powered welders are similar in design to conventional alternating-current resistance welding machines. The essential difference is that a bank of storage-battery cells replaces the customary welding transformer. The mechanical operation of battery type spot, projection, roll-spot, and flash welders—stationary or portable—is the same as in conventional machines. Control equipment for battery welders, such as timers, "heat" regulators, and contactors, are simpler and easier to maintain than those for other types of stored-energy machines.

The Range of Application of Storage-Battery Welders

The flexibility of storage-battery welders seems to be unlimited. Their welding capacity can be extended merely by increasing the number of cells used, and welding rates depend primarily on the output capacity of the battery charger employed. The range of materials that have been successfully spot- and projection-welded extends from very thin gage mild and stainless steel to heavy gage (3/16 inch) aluminum-alloy sections. Although the possibilities of flash welding with battery power have not yet been fully determined, exceptionally good flash welds have been made on aluminum and other metals having a narrow plastic range—materials that have heretofore been considered unsuitable for flash welding.

A typical battery-powered welder installation is shown in Fig. 1. This type of machine houses twelve storage cells. At the left is the charger unit with an electronic timer mounted at the top. This welder makes 240 spot welds in assembling the frame shown, which is made from laminated thicknesses of 1/8-inch structural steel. Approximately six assemblies are completed per hour. The total output for two ten-hour shifts is around 29,000 welds. The welds are closely spaced in rows, permitting a weld to be made every 1/2 second by automatic machine cycling. The machine supplies 20,000 amperes of welding current with a total power-line demand of only 26.7 KVA. In addition, the load is continuous and balanced on all three phases of the power supply at approximately 85 per cent power factor.

Fig. 1. Typical Storage-battery Resistance Welder Installation. About 29,000 Spot Welds are Produced in 1/8-inch Steel Each Twenty-hour Day. The Power Demand is Only 26.7 KVA, Balanced on Three Phases. Power Factor, 85 Per Cent

The Water-Cooled Battery

In welding service, it is desirable to maintain as high a charging rate as possible, in order to obtain the maximum output with the least number of batteries. The effective capacity of a storage battery is limited, however, by the temperature rise of the cells during charging and discharging. The use of a new type of battery, designed originally for maritime service, plus the addition of an internal water-cooling circuit, has increased the practical capacity several times over that of conventional batteries. In addition, the life of the battery is increased and maintenance reduced.

Cooling of the cells is accomplished by the use of some 50 inches of 1/4-inch outside diameter lead tubing in the electrolyte near the top of the cells. Tap water is circulated through the tubing at a rate determined by the requirements of the operation. The lead tubing is insulated from the plates by hard rubber, and is protected from contact with the terminals by enclosing it in rubber sleeves at these points. Positioning of the cooling circuit near the upper surface of the electrolyte also reduces the excessive loss of electrolyte associated with uncooled batteries. Precise control of the battery voltage during charging greatly decreases the generating and escape of hydrogen, even with the welder under heavy-duty operation.

Micro porous separators retard the loss of active material by the plates. Deep sediment receptacles at the base prevent the normal accumulation of sulphide from "shorting" the plates. Each cell is provided with six heavy terminals, in place of two, to reduce the voltage drop of the cell to a minimum and provide ample capacity for an average of 7000 amperes normally delivered by each cell during welding. Even at high-duty cycle service, the cells remain cool.

The cells are "banked" as required for the specific welding service; that is, two or more cells are connected in series to provide the proper welding voltage—usually 4 to 10 volts—and a sufficient number of cells are connected in parallel with these to supply the amount of welding current needed. Banks of six, eight, twelve, and sixteen cells are common. The size of the battery selected for a particular welding operation usually has a reserve capacity sufficient to make approximately 2000 welds in the event of power supply failure.

The Contactor-Controller

The construction of a typical heavy-duty contactor-controller capable of making and breaking welding currents up to 40,000 amperes continuously 200 times a minute is seen in Fig. 2. Three circular copper-alloy plates, with connection terminals, support four carbon-graphite contact disks.

Mounted below an air cylinder, the upper plate is connected to the piston through a cam linkage. When assembled with springs and guides, the contact surfaces of the plates are just barely separated

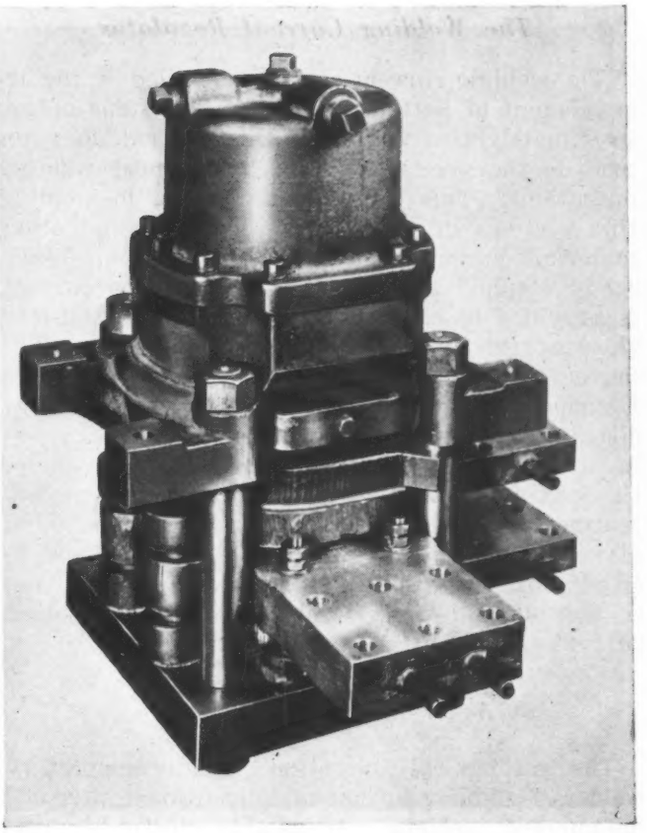


Fig. 2. The Heart of the Storage-battery Powered Welder is the Air-operated Contactor-Controller. The Unit Illustrated is Capable of Interrupting up to 40,000 Amperes without Arcing

(0.090 inch space, maximum). When the contactor is operated, the carbon disks used are forced together under a pressure of approximately 1000 pounds per square inch—amounting to a 50-ton pressure on one size unit.

When pressure is first applied to the plates, the resistance to the flow of current is extremely high. As the pressure increases, the resistance of the carbon disks to the flow of current decreases rapidly, until, under full pressure, there is practically no resistance, and the full welding current flows through the contactor.

To stop the current flow, the air pressure is removed, allowing the springs in the assembly to separate the plates. Upon release of the contacting pressure, the resistance of the plates increases rapidly with the decrease of pressure, so that, at the instant the plates separate, there is practically no remaining current to be interrupted. Proper selection of the carbon-graphite material and the thickness of the disks provides the desired pressure-resistance characteristics.

No arcing occurs at the contacts. The only visible indication of current interruption is the presence of occasional minute incandescent particles of carbon dust that glow momentarily between the separating contact surfaces. Water-cooling circuits in the copper mounting plates carry away the heat generated, permitting continuous recycling all day.

The Welding Current Regulator

The welding current can be controlled by the arrangement of battery connections in steps of approximately two volts, but this method does not provide the precision required for most welding operations. This is particularly true in welding thin sections of steel or of aluminum and other materials having a narrow plastic range. Wide-range, stepless adjustment of the welding current is provided by means of a lead-covered cast-iron rheostat interposed in the welding circuit. The movement of a sliding contact block along a U-shaped member introduces resistance into the circuit according to the requirements. The adjustment range is usually from 50 to 100 per cent of the maximum current. A quarter turn of the adjustment arm locks the contact block in place and also indexes it on a graduated scale for calibration or resetting reference. Both resistor element and contact block are water-cooled to maintain constant current regulation over a wide welding range.

The Welder Control System

The mechanical operation of storage-battery welders is similar to that of conventional alternating-current welders. Adjustable electrode pressures, provided for squeeze, weld, forge, and hold intervals, are supplied by a pneumatic system. Two solenoid-operated valves admit air to either end of the rocker-arm air cylinder. The upper valve (normally open) separates the electrodes. The lower valve (normally closed) provides squeeze, weld, hold, and differential pressures when open. Closing the upper valve while the lower valve is open provides forge pressure, exhausting the upper cylinder. The timing and sequencing of the valve movement is by a simple electronic timer and a two-stage foot-operated initiating switch. Additional controls include movable arm retraction and a light electrode pressure for point dressing.

A simple differential-cam type timer is often used in place of the electronic timer. The cams are mounted on a common shaft for direct operation of the air valves. A single-revolution clutch, controlled by the initiating switch, engages an adjustable-speed drive to rotate the camshaft each welding cycle. The operation of this type of timer is more easily understood by the operator than that of an electronic device.

Battery Charging Control

Three-phase full-wave dry disk type rectifiers and specially designed controls are employed to convert the usual factory alternating-current power to direct current and to maintain the storage cells at the proper charge. The charger and controls can be assembled as a separate unit or one or more components can be housed within the welder. The charger is fully automatic, and requires little attention, except when changing welding operations.

A tapped auto-transformer and two selector switches provide a wide range of current adjustments for both high and low charging rates. The low charging rate supplies sufficient energy to the cells for the usual welding rates. When the welder is operated at high-duty cycles, the high rate is automatically selected. The control is essentially a sensitive voltmeter connected to one pilot cell of the battery, operating a simple electronic circuit to automatically maintain the battery at a preset voltage. The usual practice is to limit the variation of potential of the cells to between 2.07 and 2.2 volts. This allows a tolerance of only 3.25 per cent, which provides satisfactory regulations for most welding processes. Although highly sensitive, heavy damping prevents the demands of a single weld from starting the charger. When the welder is idle, the charger operates periodically, equalizing the charge among the cells.

Battery power provides a large reserve of power capacity that is not affected by fluctuations of power-line voltage due to the operation of other electrical equipment on the same circuits. It is often desirable to house the batteries, current regulator, and contactor-controller in a separate "package" unit to provide additional flexibility for battery-powered welding equipment. The "power-pack" unit can be connected to any type of battery welder, and other power-packs can be connected to the same machine to increase its welding capacity in steps of approximately 25,000 amperes of welding current. Thus welding equipment need no longer be confined to a narrow range of utility. The interchange of machine and "power-packs" can provide almost unlimited conversions in cases where product redesign or major engineering changes are necessary.

The heading illustration shows a battery welder installation at the Aluminum Goods Mfg. Co.'s plant in Manitowoc, Wis. This group of six welders are assembly-welding aluminum containers. The material is 0.081-inch thick 3S aluminum. Eighty-four spot welds are required to assemble the containers and attach the handles and locking devices.

* * *

Industry Conference on Ball and Roller Bearings

Thirty-eight representatives of industry, government agencies, and the Army and Navy recently met in New York to consider a numbering system for ball and roller bearings to be prepared as an American Standard. A common numbering system would have eliminated many difficulties and much wasted effort during the war. It is obvious that similar difficulties and wasted effort can be eliminated by adopting a common numbering system for peacetime use. The conference recommended that the American Standards Association plan the setting up of an American Standard numbering system for ball and roller bearings.

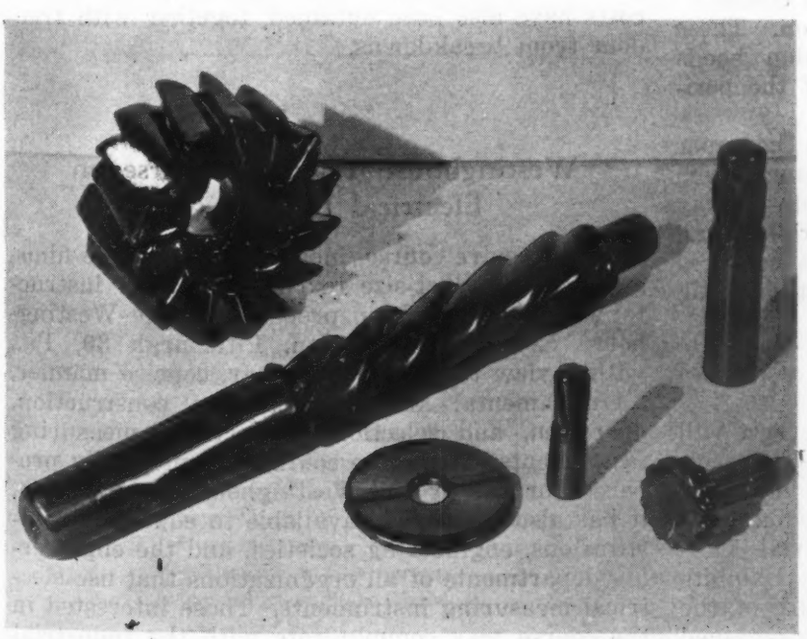
Troubles in Steam Turbines or Other Rotating Equipment Detected by Resonance Tube

THE doctor's technique has invaded the shops of industry. The accompanying illustration shows William Trumpler, design engineer of the Steam Division of the Westinghouse Electric Corporation, using a resonance tube to determine ailments of a steam turbine, just as a doctor examines the human body and interprets the noises heard through his stethoscope.

Steam turbines in normal operation produce very little noise, although the tips of the blades may move at a speed of over 700 miles an hour—faster than sound itself. When there is a hum or some other unusual noise, it is an indication that there is something wrong inside the turbine. The part that causes the noise, which may range from a worn bearing to a "stretched" blade, can be determined by using the resonance tube, coupled with mature engineering experience.

The resonance tube is simply a hollow plunger fitted into a sleeve varying in length from 6 to 60 inches. It locates discordant sounds by tuning in to the frequency of the sound, much as a radio is tuned to the frequency of a broadcasting station. This is done by extending or retracting the plunger, for at any one position only one frequency can be heard. By measuring the length of the tube at the position where the noise can be heard, the frequency is determined and the wave length of the noise can be ascertained. Wave lengths of trouble sounds have been previously precomputed and charted, and the particular fault of the machine being tested is revealed by comparing the now determined wave length with the chart.

A Westinghouse Resonance Tube that Detects Troubles in Turbines or Other Rotating Equipment, Just as a Doctor Discovers Human Ailments with a Stethoscope



Cutting Tools that have been Coated with a Transparent Cellulose Compound to Protect Them During Shipment and Storage

Protecting Cutting Tools During Shipment and Storage

Cutting edges of tools are protected during shipment and storage, cleaner and safer handling of tools is insured, rust and corrosion are avoided, and easy identification is permitted by a new method of treating cutting tools developed by the Barber-Colman Co., Rockford, Ill. The protective coating used in this process, known as "Protecto-Coat," consists of a transparent, amber-colored, cellulose compound that provides a tough yet pliable coating. The coating is applied by dipping the tool into a bath of the compound that has been heated to a temperature of 350 to 375 degrees F. The coating "sets" almost immediately upon contact with the air. The illustration shows several tools treated by this process. The coating is easily removed from the tool by slitting and peeling.

Suction Hoods Connected to Exhaust Ducts are Placed Adjacent to the Milling Cutters to Remove Fine Cast-iron Particles and Dust

Cleaner Products Obtained by Exhausting Fine Chips from Milling Machines

A dust prevention and elimination campaign that has resulted in products which are free from dirt has been undertaken by the Detroit Diesel Engine Division of General Motors Corporation. In the investigation that resulted in this campaign, it was found that the shop dust was heaviest in areas adjacent to milling and boring machines.

One feature of the scientific dust control methods employed is the use of the "vacuum cleaners" shown in the accompanying illustration. These consist of sheet-metal ducts and suction hoods which closely approximate a portion of the periphery of the milling cutters.

Large motor-driven fans are placed in the upper portion of these ducts. This creates a vacuum which draws the fine cast-iron particles and dust away from the work being milled. The heavier chips fall into the base of the milling machine. The collected dust is separated, carried out of the plant, dumped, and sold for metal scrap.

* * *

The second National Electronics Conference will be held on October 3 to 5 at the Edgewater Beach Hotel in Chicago. A technical program has been prepared comprising about fifty papers on communications, radar, television, industrial electronics, instrumentation, and research. Exhibits of electronic equipment, will be a feature of the conference. Further information can be obtained from the chairman of the publicity committee, C. A. Emery, 20 N. Wacker Drive, Chicago 6, Ill.

High-Speed Chain Drives for Automatic Screw Machines

The application of high-speed chain drives to automatic screw machines is the result of extensive testing and research work at the plant of the Brown & Sharpe Mfg. Co., Providence, R. I., in collaboration with chain manufacturers. The Brown & Sharpe organization undertook this investigation in a search for satisfactory chain drives operating at approximately 5000 feet per minute. Such speeds have not been considered practicable in the past, and chain manufacturers were not in a position to offer chain drives running at quite such high speeds.

The experiments that led to the development of successful high-speed chain drives were described in detail in a paper entitled, "High-Speed Chain Drive Developments," read by A. W. Meyer, assistant director of design of the Brown & Sharpe Mfg. Co., before the recent semi-annual meeting of the American Society of Mechanical Engineers in Detroit.

From this paper it became evident that high-speed chain drives are satisfactory when installed under proper conditions. It was found that these driving chains must first be run-in before being applied permanently to the machines. However, when the chains are properly run-in and mounted on sprockets that are accurately cut, both as to tooth spacing and tooth form, good results can be obtained. Careful attention to lubrication and proper tension adjustment of the drive at all times will insure maximum chain life. Under these conditions, the author said, chains will give outstanding performance, are ample to carry the work loads satisfactorily, withstand the shock of repeated reversals, and will have a long operating life. Appreciable reductions in maintenance and replacement costs have also been obtained, together with freedom from breakdowns.

* * *

Westinghouse Training Course on Electrical Instruments

An extensive course, including sound slide films, a complete pocket-size text-book, and an instructor's manual, has been prepared by the Westinghouse Electric Corporation, Pittsburgh 30, Pa., with a view to giving in a clear, concise manner, a fundamental knowledge of the construction, operation, and selection of electrical measuring instruments. While the course was primarily prepared for use by the Westinghouse organization, it has also been made available to educational institutions, engineering societies, and the engineering departments of all organizations that use electrical measuring instruments. Those interested in the course may communicate with the Industrial Relations Department, Westinghouse Electric Corporation, 306 Fourth Ave., Pittsburgh 30, Pa.

Arc Welding of Alloy Steels

In a paper entitled "Arc Welding of Alloy Steels," read by Robert J. Heusel of the Fisher Body Division of the General Motors Corporation before the semi-annual meeting of the American Society of Mechanical Engineers in Detroit, certain fundamental principles of arc welding were emphasized. The author called attention to the fact that much had been learned about the application of arc welding in the manufacture of war material, and that some of the fundamental principles are just as applicable to the manufacture of railroad equipment, bridges, pressure vessels, and "kiddie" cars as they are to armored vehicles. It was with these fundamentals that he dealt.

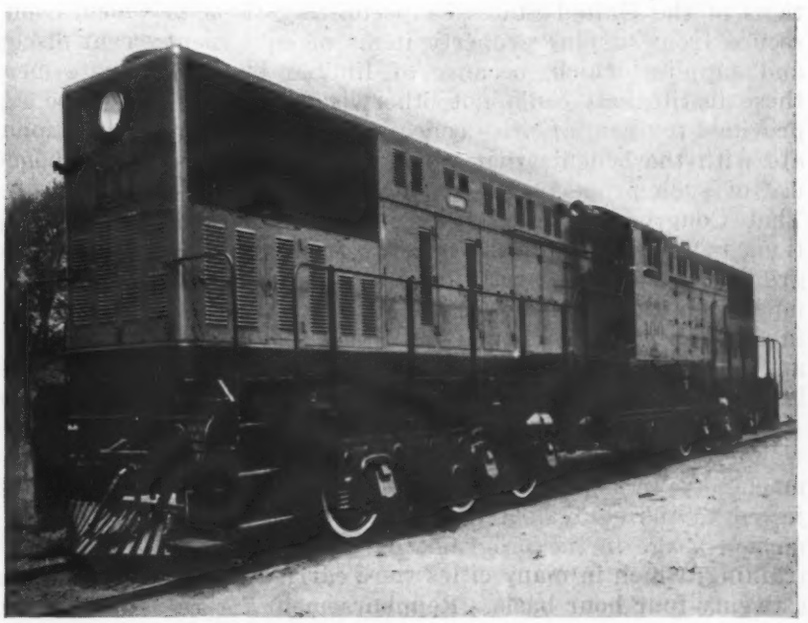
In the welding of most alloy steels, coated electrodes are generally used, because they produce soundness and strength of weld deposits. The coatings contain flux material to prevent oxidation, and often are made up of alloys which are transferred to the weld deposit, thus building up the alloy content. A coated, or shielded, electrode usually is easier to control, and the arc stability is better. Coated electrodes, however, require certain precautions in handling, because the coating material is quite hygroscopic and brittle.

It is the general practice to use a filler electrode closely approximating the base metal in chemical composition. In building military tanks, this rule was not followed, but there was a good reason for this. The tanks were made from a low-alloy armor plate having a tensile strength of about 145,000 pounds per square inch. The welding was done with a very high alloy stainless-steel electrode having a tensile strength of only 65,000 pounds per square inch in the "as welded" condition. The reason for this was that the welded tank was submitted to severe impacts from exploding shells. It was found by tests that 19-9 stainless-steel electrodes produced a weld superior to that made by other electrodes for such shock service. In fact, this electrode was the only one that was found capable of withstanding the terrific stresses to which the welded joint was exposed.

Generally, however, as previously stated, it is advisable to select an electrode that produces a welded joint deposit closely approximating in composition the metal to be joined. The American Welding Society has made a classification of commercial electrodes which will prove of assistance to anyone whose job it is to select welding electrodes. All coated electrodes, particularly those with heavy coatings, vary in performance characteristics and should be carefully selected to suit the particular job in hand, especially for large-scale welding operations. The advice of the electrode manufacturer may prove useful.

In the welding of joints for equipment such as gas turbines, jet engines, or electric motors operating at high temperatures, a high-alloy electrode should be selected, because this type has good resistance to corrosion and retains its physical properties under the conditions to which it is subjected in the type of equipment referred to.

In the pressure-vessel industry, the automatic method of arc welding has found wide application. There is much automatic welding equipment available today, some of which is capable of speeds as high as 35 inches per minute and even more. Mild steel welding by automatic arc methods has been very successful. In this work, the testing of the finished welds is highly essential because of the purpose of the welded joint, where failure would be likely to cause severe damage. Lack of soundness due to porosity, shrinkage cracks, and slag holes is a frequent cause of failure. X-ray inspection has been found a satisfactory means of testing the finished welds, and should be applied whether manual or automatic welding methods are used.



A New Baldwin Westinghouse 2000-H.P. Diesel - electric Transfer Locomotive, the Most Powerful of Its Kind. Test Runs Indicate that it can Replace Four Conventional Steam Locomotives in Hauling Freight on the Chicago Outer Belt Line. The Total Weight of the Engine is 350,000 Pounds. Its Length is 70 Feet 6 Inches. It can Operate at a Speed of 60 Miles per Hour, but was Designed to Develop High Continuous Tractive Effort at Slow Operating Speed

Surplus Equipment Should be Available to Educational Institutions at Reasonable Prices

THERE has been a great deal of activity recently on behalf of educational institutions throughout the country in trying to induce the War Assets Administration to permit such institutions to obtain Government surplus equipment at a discount greater than that which has been allowed them in the past. The Surplus Property Act of 1944 definitely states, in Section 13, that in setting the sales value of surplus property to educational institutions, the price shall be based on benefits that have accrued, or may accrue, to the U. S. Government, and that will offer an opportunity to these institutions to meet, in the public interest, their legitimate needs.

Therefore, the price charged these institutions for surplus equipment depends entirely on the interpretation of the Act relative to the benefits that can be derived from the use of the surplus property in educational institutions. The present figure of a 40 per cent discount to educational institutions is not enough to permit these institutions to acquire all the equipment that they need. The price is still beyond their ability to pay. It should be noted that the amount of the allowable discount is not specified by the Surplus Property Act itself. The 40 per cent discount is an arbitrary figure adopted by the War Assets Administration.

In order to suggest to the War Assets Administration a policy for the effective disposal of surplus property to educational institutions, the following resolution was adopted by a conference held in Washington of representatives of twenty-one national educational organizations:

"In Section 13 of the Surplus Property Act of 1944, Congress recognized that public benefit would accrue from strengthening the educational institutions of the United States by permitting them to secure from surplus property items of equipment and supplies which, because of limited budgets, these institutions could not otherwise secure. It provided further for price concessions commensurate with the benefits that would accrue from the use of such property by educational institutions. That Congress intended the educational institutions to secure significant benefits from the program of surplus property disposal was indicated, not only in the provisions of the Act itself, but also in the debate on the floor of the House and Senate and in the Conference Report, an abstract of which is given in the following:

"The contribution of American education to the war effort is well known. Tools, equipment, and machinery in many American schools were subjected to the equivalent of at least ten years of normal usage in the programs of war production training, which in many cities were carried out on a twenty-four hour basis. Reimbursement for repairs was granted, but no consideration was given to depreciation or replacement. Some of the surplus property now available could be used to replace worn-out equipment and machinery. Furthermore, many of the outstanding scientific achievements upon which the outcome of the war depended would have been impossible without the contribution of our college laboratories and personnel.

"American education may expect future benefits to accrue from the use of surplus property. An adequately equipped educational program is the very foundation of our national security. The backbone of our national defense is no longer an infantryman with a rifle. It is now radar, motorized equipment, aviation, atomic weapons, and scientific developments yet unknown. The foundation on which our national security must be built is an adequate nation-wide, educational program with special emphasis on scientific, vocational, and other skills, which must be ready for immediate call in an emergency.

"For eighteen months American education has sought avenues through which it may acquire surplus property for needed replacement and further expansion. The generous provision of the Federal Government for the education of veterans makes replacement and further expansion imperative. The thin trickle of surplus property into educational channels has in no wise met the needs, and at the same time, the huge surplus stockpile has grown to such an extent that some equipment cannot be cared for and is left to deteriorate and become wholly unfit for any use other than sale as scrap.

"Yet under present surplus property regulations, educational institutions cannot purchase this equipment even as scrap. An arbitrary figure of 40 per cent discount from a fair value is a totally inadequate measure of the benefits that might reasonably be expected from the use of such property for educational purposes. In order to insure the maximum benefits to the United States from the use by schools of surplus property, the disposal price must be a nominal price.

"The second factor depriving education of the benefits intended under the Act is to be found in a period of offering too short to permit proper distribution. The plan proposed by the U. S. Office of Education to provide for orderly distribution was scuttled because the time period of offering requested was not approved by the disposal agency. An adequate period of offering and a plan for reserving quantities of essential items for education are imperative if significant benefits are ever to be achieved.

"Another factor depriving educational institutions of intended benefits is the setting by disposal

agencies of minimum quantities which are much too large — in many cases, too large for even the largest institutions in the United States. Combined with a short offering period, which makes attempts to pool orders at the county or state level impossible, these large minimum quantities rule out all attempts to purchase many items.

"The need of education is so great that the intended benefits to education must be made possible by official recognition of the following: (1) A policy of nominal pricing, namely, the cost of care and handling, which will truly reflect the public benefits accruing from the use of such property. (2) Provision for not less than a thirty-day period of offering in order to permit fair and orderly distribution of property. (3) Reservation of property in terms of estimated quantities required by educational institutions. (4) Revision downward of minimum purchase quantities to permit smaller educational units to fulfill their needs."

* * *

Machine Tool Scale Models and Templets for Plant Lay-Outs

A standardized line of three-dimension templet-base machine tool models, with each base cut to the over-all scale dimensions of the floor space required by the machine under maximum operating conditions, has been made available to industry by Visual Production Planning Inc., 101 Park Ave., New York 17, N. Y. The die-cast machine top mounted on the model base enables the type and kind of machine tool represented to be easily recognized.

These models, which are available for practically all standard machines and shop equipment, can be quickly arranged to give the answer to many problems encountered in considering proposed plant lay-outs. They often eliminate days and weeks of drafting time. Photographs of the model lay-outs can be used as permanent records, and serve as the equivalent of working drawings. The model lay-out permits group analysis by those untrained in the reading and interpretation of blueprints, and thus brings more ideas and better criticisms to bear on the various problems.

When used in conjunction with operation sheets, time standards, and piece-rate data, the models provide exact methods of balancing production lines before making proposed changes in the arrangement of machine elements. By using color code systems, proposed changes can be easily visualized well in advance of change-overs. They enable plant safety problems to be anticipated, and also facilitate group training and orientation of workers in plant geography, traffic problems, material flow, and production procedures.

Models of practically every type of standard machine tool, as well as of such equipment as gravity conveyors, lockers, trucks, tote boxes, and benches, together with models of men and women workers, are obtainable. Office planning equipment is also available in 1/4- and 1/2-inch scale models, and includes all types of desks, chairs, files, etc. required for a complete office lay-out.

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Life Tests of Single-Point Cutting Tools Now Standardized

The American Standards Association has approved as an American Standard, known as ASA B5.19-1946, methods of making life tests of single-point tools made from materials other than sintered carbides. This standard has been accepted by the National Machine Tool Builders' Association, the Society of Automotive Engineers, and the American Society of Mechanical Engineers, who were joint sponsors for the standard. Copies of the standard can be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

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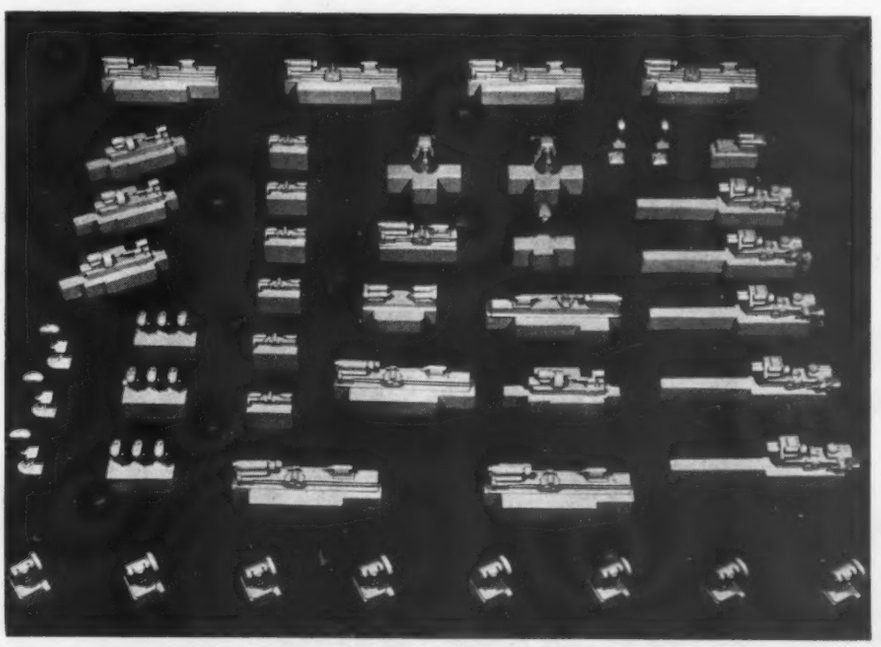
Few Americans recognize how many liberties have been lost through the Government controls of the last few years, in peace and war alike. Freedom is easy to lose, but hard to regain.



Scale Models of Machine Tools for Use in Production and Plant Lay-out Planning

From Aluminum Oxide to

Spectacular Operations in the Production of Aluminum Sheets and Plates in the Modern Plants of the Aluminum Co. of America Located at Alcoa, Tenn. These Illustrations

Fig. 1. Aluminum Sheets are Hot-rolled from Slabs 1/4 to 3/4 Inch Thick in a Five-unit Continuous Mill. This Mill Transforms the Slabs into Sheets from 0.100 to 0.200 Inch in Thickness at the Rate of Hundreds of Feet Per Minute

Fig. 2. Long Row of Electrolytic Cells in which Alumina (Aluminum Oxide) is Dissolved into Molten Cryolite and Separated into Its Component Parts of Aluminum and Oxygen by Passing Electricity through the Mixture. The Capacity of Each Cell is Approximately 500 Pounds of Aluminum per Twenty-four Hour Day

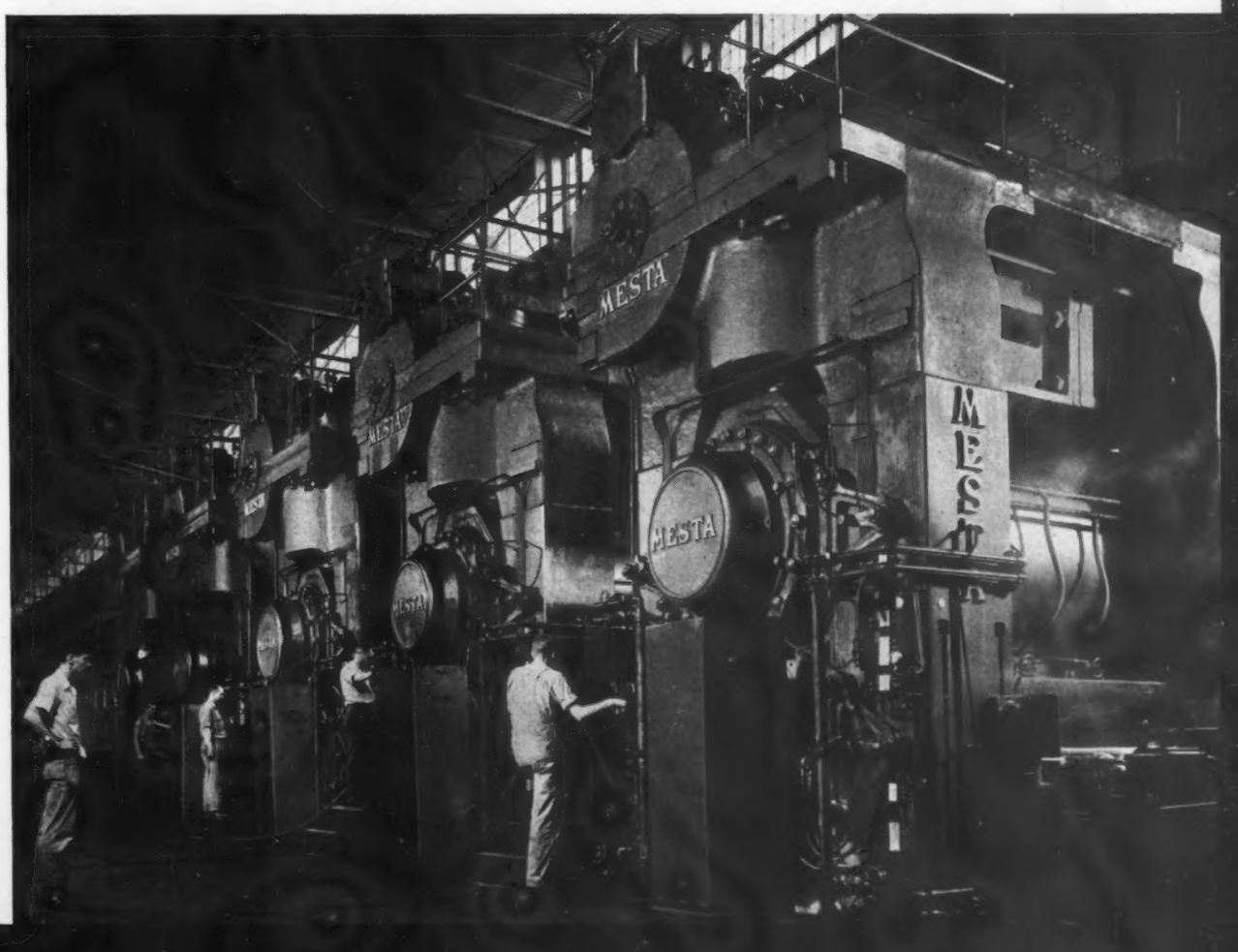
to

Rolled Aluminum Sheets

Show Various Steps in the Manufacturing Process, Starting with the Production of Aluminum from Aluminum Oxide and Ending with the Rolling of the Sheets

Fig. 3. Coils of Aluminum Sheet Stock Ready for Annealing. After Annealing, These Sheets are Reduced to Final Thickness in Huge Four-high Cold-rolling Mills Capable of Making a Heavy Reduction in Sheet Thickness at Each Pass

Fig. 4. Entry End of the Battery of Five Huge Mills which Receive the Heated Slabs of Aluminum and Transform Them into Aluminum Sheets Hundreds of Feet in Length at a High Operating Speed. Each of These Mills Operates at a Progressively Higher Speed, so as to Take Care of the Increasing Length of the Sheet



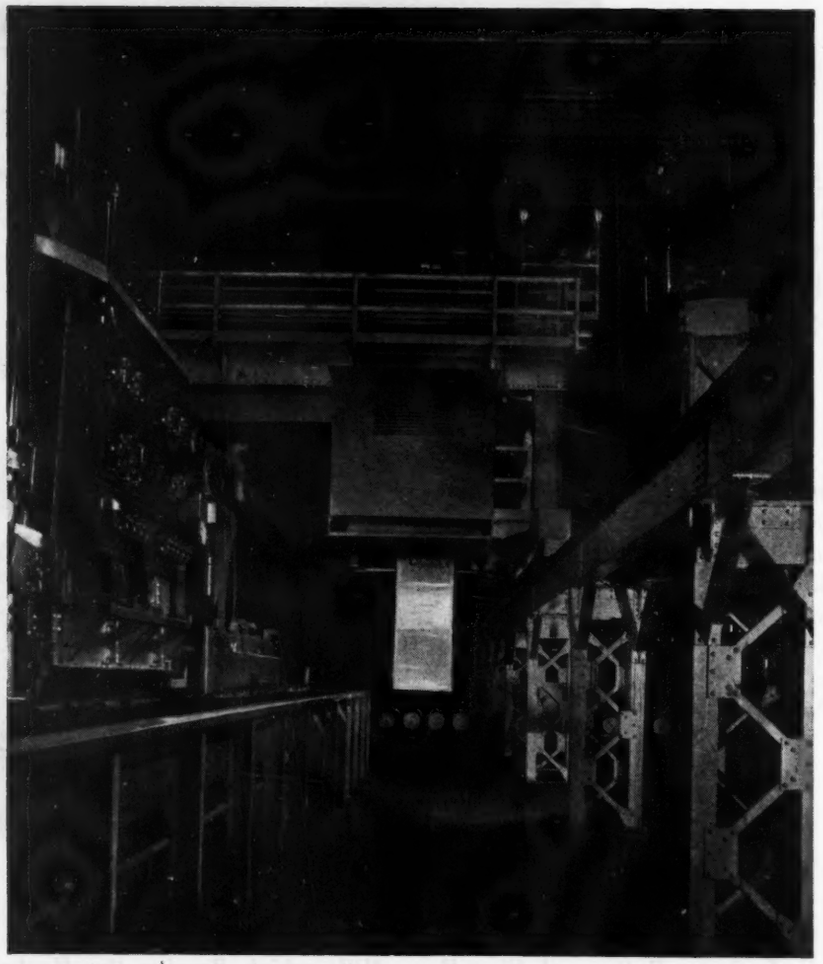


Fig. 5. (Left) Transferring an Aluminum Ingot by Means of a Stiff-leg Crane to the Soaking Pits where It is Heated to a Suitable Temperature for Hot Rolling — the First Step in the Manufacture of the Sheets. Ingots Range from 6 to 12 Inches in Thickness

Fig. 6. (Below) Close-up View of One of the Electrolytic Cells in which Aluminum is Obtained from Alumina. The Aluminum is Deposited in the Bottom of the Cell as a Molten Layer, is Tapped from the Cell into Large Mixing Ladles, and Cast into Pigs Weighing About 50 Pounds Each

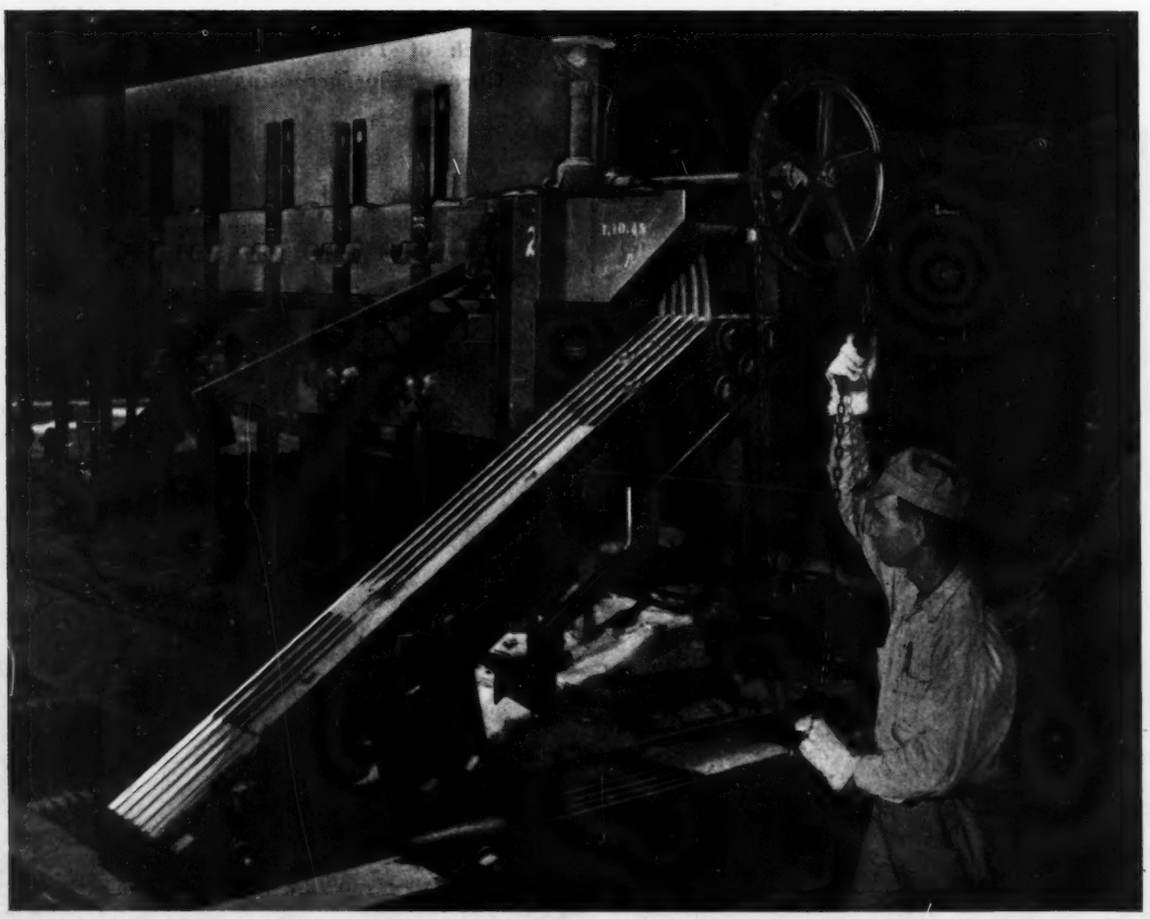


Fig. 7. (Right) Coiling Aluminum Sheet Stock as It Reaches the End of the Run-out Table Seen in Fig. 1. As Each Coil is Completed, It is Automatically Transferred to the Left and Turned into a Vertical Position for Transfer to the Storage Department (Fig. 3)

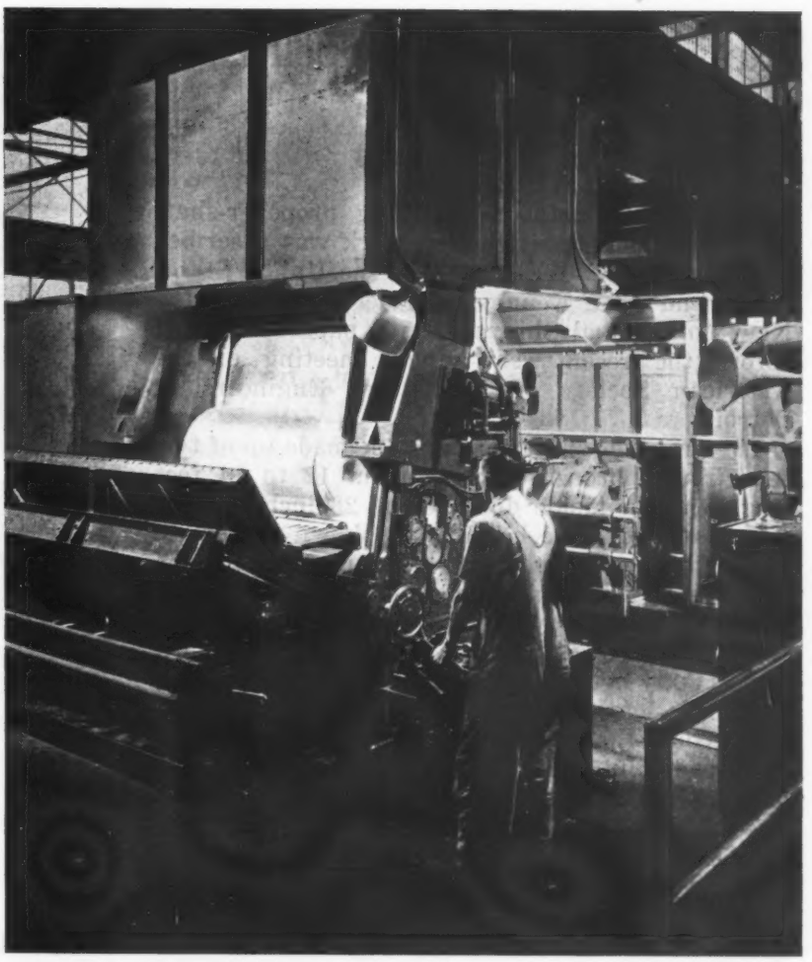
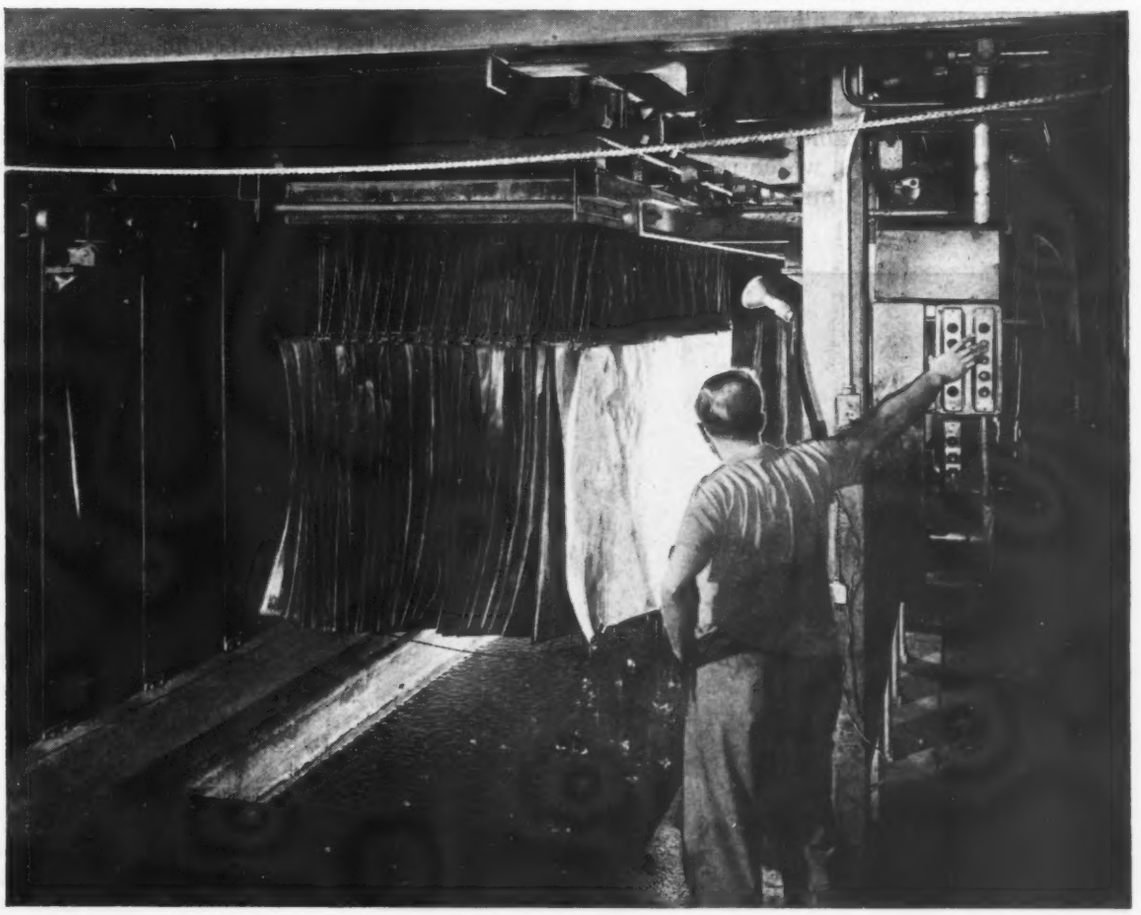


Fig. 8. (Below) After Final Rolling Operations, Sheets of Heat-treatable Aluminum Alloys are Subjected to a High-temperature Thermal Treatment, and then Quenched and Age-hardened. A Number of Heat-treated Flat Sheets are Seen at the End of the Quenching Step



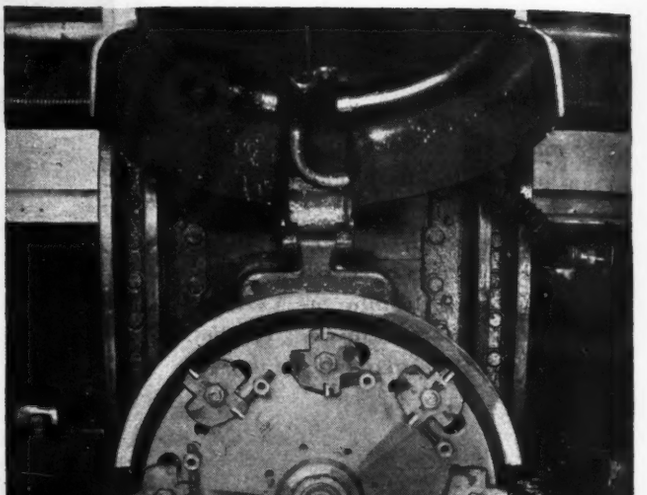
Rapid Milling of Propeller-Shaft Bearings

An unusual method of milling propeller-shaft bearings in ship construction work was described by Lieutenant C. A. Palmer, of the United States Navy, and J. G. Kenney, carbide engineer at the New York Naval Shipyard, in a paper presented before the recent semi-annual meeting of the American Society of Mechanical Engineers in Detroit.

The propeller-shaft bearings are made up of two semicircular bronze castings from 12 to 14 feet long, with an inside diameter of 23 inches. The end of one of these bearings is shown in Fig. 2. Ten dovetail grooves, filled with rubber or lignum vitae strips which support the shaft, must be machined longitudinally in each half-bearing. In the past, each groove was machined individually on a planer, sixty hours being required to complete each half shell.

To reduce the machining time on this job, a multiple-head milling cutter was designed and made. This enabled each half-bearing to be machined in three hours. The cutter-head was fitted to the cross-head of the planer, as indicated in Fig. 1. This head holds ten pairs of carbide-tipped milling cutters, one pair for each groove to be cut. The cutters are driven by means of a telescoping shaft from a motor mounted at the rear of the planer. The telescoping shaft allows full travel for the planer table. The table travel speed was reduced to a suitable rate for the feed.

To perform the operation, the half-bearing is placed on the planer table in a semicircular cradle and fed into the cutters, which rotate at 400 R.P.M. (320 surface feet per minute) at a feed of 0.001 inch per tooth. All ten grooves are rough-milled at one pass of the table. The leading cutter machines the bottom of the groove, and the following cutter the dovetails. Then the roughing cutters are replaced with finishing cutters for the second pass, which operate in the same manner. When a number of bearings are to be machined, the bearings are first all rough-machined, after which they are all finish-machined.



At the same time that the multiple cutter-head machines the dovetail grooves, the facing plate shown in Fig. 2, which holds eight carbide fly-cutters, bores the bearing to the correct inside diameter. This facing plate rotates at 110 R.P.M. (690 surface feet per minute), with a feed of 0.008 inch per tool. It is driven from the same motor as the milling cutter head.

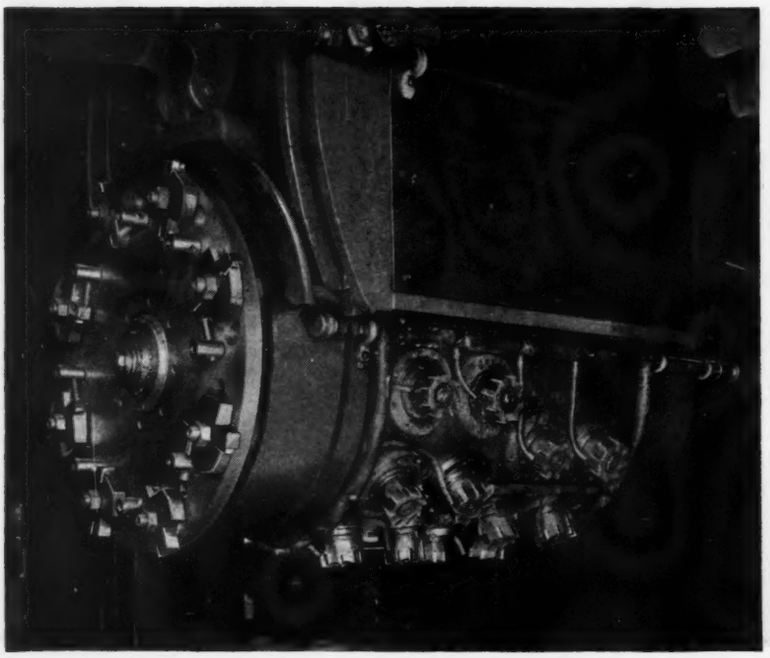


Fig. 1. (Left) Multiple Milling Head with Ten Pairs of Carbide-tipped Milling Cutters for Milling the Dovetail Grooves in the Bearing Shown in Fig. 2

Fig. 2. (Above) Facing Plate with Eight Carbide Fly-cutters Used for Boring the Inside Diameter of the Shaft Bearing

Induction Heating Applications in the Machine-Building Industries

A Comprehensive Review of the Application of Induction Heating to Processes in the Metals Industries was Presented before the Semi-Annual Meeting of the American Society of Mechanical Engineers in Detroit by Harold A. Strickland, Jr., Chief Engineer of the Induction Heating Division of the Budd Co. An Abstract of This Paper is Presented Here

HISTORICALLY, the idea of induction heating is not new. Attempts were made to heat metal inductively as far back as 1892, and there is a patent application relating to this subject dated 1888. Commercially, however, induction heating is a comparatively recent development. The war period gave a great impetus to the applications of this process. It is estimated that in 1932 induction heating equipment equivalent to 37,000 K.W. was installed. This rose to 300,000 K.W. in 1944, and at the present time, this figure is considerably higher.

Like many other new developments, induction heating has been made the subject of much glamour and some misunderstanding. The fact that the currently popular word "electronics" is applicable to some of the power converters used for induction heating has not lessened this confusion. To make this review reasonably complete, let us first answer the question: "What is induction heating?"

Principles Involved in Induction Heating

Induction heating is a process of electromagnetically inducing a circulating electric current in a conducting piece of work to produce useful heat. The process is analogous to the production of heat energy in a short-circuited transformer secondary, with the exception that the work-piece functions both as the core and the secondary winding of the transformer.

Useful heat is generated only in the path of the induced currents, which are generally confined to the surface of the article being heated and to the zone immediately adjoining the inductor. The heat is produced by the electrical resistance losses, the same as in an electric stove or other resistance heating unit. It would perhaps be suitable to designate the process "induced resistance heating." Inasmuch as good electrical conductors have low resistance, they are more difficult to heat inductively than poorer conductors. A perfect conductor of electricity, if one existed, could not be heated inductively at all.

Heat produced inductively is sometimes credited with unique characteristics. This is misleading. The heat produced by this process is not in the least different from heat produced by other heating processes. There are properties connected with the process that are unique, but these are associated with the means of introducing the energy that is converted into heat, and not with the character of the heat energy produced.

The prime characteristics of the induction heating process are: (1) The ability to introduce heat energy to the work at an almost unlimited rate. In practice, the limiting factor is either the capacity of the induction heating equipment or the thermal rate of diffusion of the heated metal. If heat cannot be conducted from the directly heated zone, localized fusion will take place. (2) The ability to transfer energy to the work without any physical contact with the work. (3) The absence of any temperature limitation other than the melting of the work. (4) The ability to concentrate in a thin surface zone of the work practically all of the energy introduced.

High Frequencies are Used in Induction Heating

High frequencies, that is, frequencies that are higher than those obtainable from standard power lines, are generally employed in induction heating. While the use of higher frequencies involves the added cost of a frequency converter, this cost is largely offset by the economies realized in the cost of power-factor correction capacitors.

There are two basic types of high-frequency current sources for induction heating. These are rotating equipment and oscillatory equipment. By far the largest amount of induction heating is produced from motor-driven inductor alternators. High-frequency current is generated in the stator windings of an inductor alternator by flux ripple, which is set up by a toothed rotor. Because the generator rotor has no electrical windings or connections, and may even be a single solid forging of steel, it is a simple and extremely rugged piece of equipment.

Oscillators constitute the second class of high-frequency current sources. These include (1) spark-gap oscillators, (2) vacuum-tube oscillators,

and (3) mercury-arc inverters. Spark-gap oscillators are available only in small sizes. They cost slightly less than vacuum-tube oscillators on a power-output basis, and are commercially restricted to frequencies of about 200,000 cycles.

Vacuum-tube oscillators are virtually unlimited in frequency output, although their ratings frequently diminish above 1 1/2 megacycles. Since very little induction heating is done above 1/2 megacycle, this is unimportant. The application of both spark-gap and vacuum-tube oscillators is primarily to work of small cross-section, where the frequencies of motor-generator sets are too low for efficient heating.

The mercury-arc inverter is the newest induction heating power source. It is available at present in frequencies up to 1000 cycles, which limits its application to through heating of steel over 2 3/8 inches in diameter. The mercury-arc inverter has a slightly higher efficiency than motor-generator sets, and is obtainable at about the same price per kilowatt.

Coils Used for Induction Heating

While much of the first cost of an induction heating installation is for the equipment for changing commercial power to higher frequencies, the induction heating coil is the basic component of the system. All induction heating coils are fed with relatively high currents. The coils are generally water-cooled to carry away the heat losses of the coil, which creates the illusion of heat flowing from a cold coil to an incandescent work-piece. Induction heating coils may be divided into five classes: (1) Single-turn "outside-diameter" coils, generally machined from solid copper; (2) multi-turn, usually helical, external heating coils; (3) pancake coils; (4) internal heat heads; and (5) special coils conforming to the requirements and shape of the work to be heated.

The solid single-turn inductor is used mostly for heat-treating and localized brazing. It is ideal for application to heat-treating when quenching water is present, and to silver soldering when flux is present. It is frequently built with a quenching passage through its walls to allow heating and quenching in a single operation. The multi-turn coil is generally used where larger areas are to be heated and higher efficiency is required. The multi-turn coil is often used when a solid inductor might be used at a lower frequency. Multi-turn inductors range from a few turns of bare copper tubing to highly specialized forge heating coils, which are thoroughly insulated electrically, waterproofed, and equipped with water-cooled work-support rails.

Pancake coils are used to heat-treat the face of a section, to spot-heat zones in large flat areas, and to heat entire sections where the sections would be too thin to orient the flux parallel to the axis of the work. The efficiency of a pancake coil is not as great as that of an external coil, but it is high enough to be commercially applicable.

Internal heating and heat-treating coils constitute a field by themselves. They are the most complicated of the general types of inductor coils, and to obtain efficiency in the limited spaces of an internal aperture, they are designed and built to close tolerances. Most internal coils are wound on laminated iron cores to improve their coupling, which, without the cores, would be inferior to that of an external coil.

Special coils of almost any form can be built. These include coils for the heating of odd-shaped pieces or for the introduction of odd heat patterns into regularly shaped pieces. They are limited only by the ingenuity of the designer and the fundamental laws of magnetism.

In designing special coils, it is well to remember the following: (1) Heat is produced only in the path of the current flow; current attempts to flow directly under, and parallel to, the current flow in the inductor itself. (2) Current and flux never turn corners sharply. They always tend to follow a smooth streamline flow. (3) The path of the current in the work must be complete. Current can only flow in a closed circuit and the circuit constituted by the work-piece must be complete. (4) Concentration of current, and therefore of heating, in the work-piece decreases rapidly with increase in spacing of the inductor element from the work. The heating effect is inversely proportional to the square of the increase in spacing at close distances.

Applications of Induction Heating

Differential surface hardening by the induction method produces a superior product, in combination with an excellent production method. Its advantages are becoming increasingly evident, especially as pieces are designed to take advantage of it as a means of production. From a heat-treatment point of view, it has the following advantages: (1) Very low distortion. (2) No scaling other than a slight coloring oxide which, when it can be retained, probably improves the wearing properties of the piece. (3) Practically no surface decarburization. (4) Differential and zone hardening without necessity of plating or other shielding of soft sections as required in carburizing procedures. (5) Extremely short production time per piece. Frequently, it is a production-line operation with the heat-treating machine in line with other machining operations. (6) Small space occupied on the production floor. (7) Deep cases provided as quickly and easily as shallow cases. (8) Adaptable to automatic handling. (9) "Superhardness" at intermediate carbon contents.

Static and Progressive Heat-Treatments

Induction hardening is done either statically or progressively. In static heat-treating, the part is placed in a fixed relationship with an inductor. Energy is applied to the inductor, immediately followed by a quench. Quenching may be by water

(which is most usual), cold back metal (which is frequently used), oil, or hot salt. The two latter quenches are less often employed, as they are relatively difficult to handle and satisfactory results can usually be obtained without them.

Some quenching is done following static heating by dropping the work-piece into a quench bath. Although a simple device, this often produces unreliable results, because the quenching action is dependent upon the manner in which the piece falls into the bath. In differential hardening, the quenching procedure is perhaps more important than the heating in producing uniform and satisfactory hardness patterns. Quenching must be done accurately to secure accurate results. This constitutes one of the advantages of induction heating, for it is easy to produce accurate quenching results by most induction hardening fixtures.

In progressive heat-treating, the part and the inductor are in motion relative to each other while the power is applied to the inductor. This causes the work to be "scanned" by a moving zone of heat. Here, again, a water quench is generally used in conjunction with the inductor, but back metal or oil quenching may be employed.

In heating ordinary low- and medium-carbon steels, most of the factors determining the results are constant, and variations center around the rate of power input, the section mass, and the applied frequency. The most frequently inductively hardened steel is S A E 1045. It can be hardened to as high as 64 Rockwell C. Sorbitic prior structures are desirable, but many pieces are induction hardened "as cast" or "as forged." An energy input of 30 to 35 kilowatt-seconds per square inch is a common figure for the surface hardening of steel.

Stresses Produced by Induction Heating

No discussion of differential heat-treating is complete without some reference to the stresses introduced by the hardening operation. These stresses may be favorable, unimportant, or adverse. As an example of favorable stresses, one manufacturer of steam-hammer piston-rods has found that an external induction heat-treatment has improved the fatigue life of these rods more than 200 per cent. In another case, where the stresses were not favorable, a Diesel-engine manufacturer found that there was a reduction in endurance limit of from 10,300 pounds per square inch in an unhardened crankshaft to 7700 pounds per square inch in an induction-hardened crankshaft, although subsequent shot-peening raised the endurance limit of the induction-hardened shaft to 10,800 pounds per square inch. These examples indicate some of the experiences with residual stresses.

The characteristic pattern of stresses in a differentially hardened piece is (1) a hardened surface zone under compressive stress; (2) a transition zone adjacent to or under the hardened area in tension stress; and (3) a balance of the material with either neutral or compressive stress.

Peak stresses can be reduced by tempering at a maximum stress-relieving temperature; preheating before hardening to minimize temperature gradient; deep-pattern heat-treating; cold-working to reverse stress directions; reducing power and increasing the heat time to move the tension zone deeper into the work; or quench delaying to allow maximum time for ferrite solution and thereby produce a maximum of martensitic zone.

Through Hardening by Induction Heating

Through hardening by induction heating is not only possible but practical. The rate of heating is not overly important. For through hardening, the induction method furnishes a compact, rapid process in which metallurgical and stress effects exist as in conventional heat-treating. The maximum rate of heat input is limited primarily by the rate of heat equalization in the work.

Some induction hardening is done in conjunction with prior carburizing. This process produces excellent work, but has fewer production advantages than differential hardening.

Induction Heating for Brazing

During the war, induction heating for brazing was adopted on a wide scale. It proved to be an excellent means of heating assemblies for use with the new low-temperature silver brazing alloys. Its cleanliness and ability to produce an excellent job with unskilled labor greatly widened the acceptance of brazing as a production tool. Many brazing alloys for use at various temperatures are available on the market.

Generally speaking, the parts to be brazed are cleaned and preassembled with a paste flux and preshaped rings or sections of brazing alloy. The assembly is then placed in a fixture in a predetermined relation to an induction coil, and the proper localized heat for the brazing operation is supplied automatically by the induction heating equipment. Normal heating time for this type of operation varies from ten seconds to one minute. Excellent results can be expected if several simple rules are followed. Fundamentally, it is necessary to heat the entire joint to the brazing temperature, avoiding the overheating of any part. To accomplish the best results, the following points should be observed:

1. Design the inductor to apply heat to the heaviest section of the joint.

2. Avoid too rapid heating. It is often better to use a longer heating time and a multiple fixture, heating several pieces simultaneously, than to attempt to secure the same production from a single coil and fixture, using too short a heating time.

3. Avoid overheating. Don't boil all the brazing material out of the joint. Temperatures above 1600 degrees F. cause deterioration of low-temperature silver flux, allowing scaling to proceed at a rapid rate.

4. Be sure that the set-up brings all surfaces of the joint to be brazed well up to the brazing temperature. A satisfactory joint cannot be obtained with only one side of the joint at the brazing temperature, although solder will flow into the joint under these conditions, giving the false appearance of a good braze.

5. Apply plenty of brazing flux to the zone where the braze is desired.

6. Be sure the parts to be brazed are well cleaned and free from oil.

Induction Heating for Forging

Heating for forging is perhaps the most recent application of induction heating to become widespread. It, too, received its greatest acceleration and development as a result of war demands. Having proved its value, it is now being applied to even greater proportions in peacetime applications. It has the following advantages:

1. Clean and cool working conditions are provided.

2. Virtually no scale is produced. This results in (a) lower steel cost per part, due to the elimination of direct loss of steel by scaling; (b) smaller machining stock allowance, as scale is not embedded in the surface of the forging; and (c) much longer die life, reported to be as high as 4 to 1.

3. It is an extremely high-speed operation, as metal-heating operations go. A bar of 1 5/16-inch steel can be heated throughout to forging temperature in as short a time as five seconds.

4. It requires small floor space. Induction heating units occupying as little as 24 by 44 inches floor space are available.

5. No skill is required on the part of the operator. All that he is required to do is to place the stock in the heater and press a button.

6. Great flexibility in starting and stopping production is provided. It is possible to heat a single bar or to operate at full production rate at the will of the operator. This is a great advantage in setting up jobs and in the event of die trouble.

7. Temperatures and heating times are extremely uniform. This eliminates overheating and burning and results in uniform forgings. Dies can be designed to produce almost no flash at all. In one hub forging, flash of only 2 3/4 ounces is consistently obtained from a forging weighing 8 pounds. This results in great steel economy and in lighter loading on the forging tools.

8. Less labor is required when pieces are heated inductively.

9. Owing to the small amount of material heated at any time, operation shut-downs do not involve great heat or material losses.

10. Owing to the electrical nature of the controls, production can be paced by the equipment, in cases where this is desired.

11. Coils and coil linings are quickly interchangeable. This means no furnace "down time" for relining.

12. The process is adaptable to mechanical handling. The actual space required for the heating operation is so small that the work-handling equipment, with all elements operating at room temperature, is nearly always adaptable.

Heating Equipment for Forging

Forging heating is done primarily in two basic types of heaters—bar heaters and continuous billet heaters. The continuous billet heater is a mechanically loaded device, and may be coupled with hopper feeding mechanisms. Equipment is available for the automatic feeding of stock into bar type heaters. Stock diameters above 1 1/4 inches can be heated to forging temperatures at the rate of about six pounds per hour for each K.W. of nameplate rating. Commercial power is required at about the rate of 400 kilowatt-hours for each short ton of steel heated.

It is possible to heat copper, aluminum, brass, stainless steel, and other common metals by the inductive process; in general, as many pounds per hour per K.W. can be heated to hot-working temperatures as is the case with steel. Stock diameters smaller than approximately 1 1/4 inches are heated with less efficiency than larger diameters because (1) they have a greater ratio of surface area to volume; (2) they are more difficult to couple closely; and (3) the higher frequency generators necessary for treating small stock are less efficient than 1000- and 3000-cycle converters.

Tube stock can be heated at lower frequency than solid bars of the same diameter because the current penetration is limited in a tube by the wall thickness, as well as by the high-frequency skin effect. If the tube wall is not uniform, temperature variations will be greater when the heating current penetrates through the wall, and it is, therefore, often desirable to use higher frequencies in tube heating than would otherwise be required.

Concluding Remarks

Summarizing, induction heating is a commercially new method of heating which has completed its initial stages of development. It has produced results that are sometimes completely new and at times merely improvements upon previous practice. The first cost of equipment is frequently higher than for competitive methods, but operating savings often more than offset this higher first cost. Induction heating should not be applied indiscriminately. There is a great deal of "know how" to the art, and frequently there is one best way to solve a particular problem. Most induction heating manufacturers welcome the opportunity to develop applications for their equipment. For this reason, applications that might appear to be suitable for induction heating should be discussed with established firms specializing in the induction heating field before a decision as to the practicability of the process is made.

Governing Factors in Holding Machining Costs to a Minimum

In a paper presented by Lawrence S. Martz of the Micromatic Hone Corporation, Detroit, Mich., before the recent semi-annual meeting of the American Society of Mechanical Engineers held in Detroit, the author pointed out that there are many factors that influence the cost of machining processes besides cutting speeds and feeds. While the paper, entitled "What's New In Honing," dealt specifically with honing processes, many of the statements apply to all machining methods.

The author called attention to the fact that it has recently become increasingly obvious that heavier feeds and faster speeds, even when tripled and quadrupled, can be of little benefit if there is no accompanying decrease in the amount of time required for loading and unloading the work, for inspection, and in the "down-time" for equipment repairs or replacements, adjustments, and similar factors. Also, the benefits of faster cutting operation can be quickly nullified by a continuing condition of labor inefficiency, arbitrary interference with production planning and scheduling, and increases in material costs.

The conviction is now voiced by many production executives that production per man-hour can be satisfactorily increased only by more carefully controlled stock removal, and *less of it*, combined with automatic work-handling and machine operation, and improved methods of work inspection. It is considered equally necessary to assure more dependable interchangeability of parts.

Those engaged in the machine tool industry recognize that this is a logical step in counteracting the evils which beset our production system today. In the honing process, this has inspired two important new developments: The first now makes it possible to remove from twenty-five to thirty times as much stock as was formerly practicable, at rates up to ten or twelve times as fast as in pre-war practice; the second comprises automatic size controls which hold the final diameter within 0.0003 inch in most applications.

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New Plastics Molding Film

The story of completely automatic molding is told in a new full-color 16-millimeter motion picture, entitled "Robots at Work," prepared by the F. J. Stokes Machine Co., press manufacturer. The picture shows hand-molding and manually operated and semi-automatic presses, as well as automatic equipment. Typical examples of moldings best suited to automatic production are also shown. Controls and other mechanisms of the automatic presses are described in detail. The running time of the film is thirty minutes. Prints can be obtained for showings to engineering and industrial groups by addressing the F. J. Stokes Machine Co., Tabor Road, Philadelphia 20, Pa.

Proposed Revision of Simplified Practice for Grinding Wheels

The National Bureau of Standards has announced that a revision of Simplified Practice Recommendation R45-39, covering grinding wheels, has been proposed by the Grinding Wheel Manufacturers Association. Among the important changes suggested are the addition of a number of shape types, including cones and plugs, not previously listed. Also, the new recommendation will include a greatly improved method of "use classification," which will facilitate the selection of wheels of suitable size, shape, and bond for practically every present-day need. Copies of the proposed revision can be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

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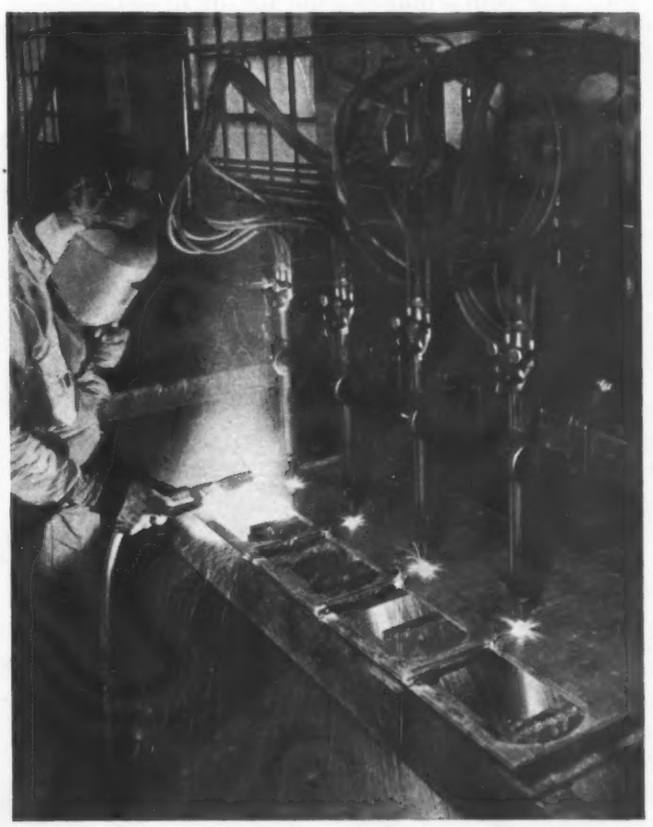
Eliminating Distortion in Torch Cutting Operation

In a multiple-torch cutting operation at the plant of the Service Welding Co., Ridgefield, N. J., an Airco electrode is employed to tack-weld the points of entry of the Oxygraph torches through the 1/2-inch steel plate being fabricated. In this way, the cut steel is restored to a continuous plate and the cut sections are prevented from rising out of horizontal alignment with one another.



Tack-welding the Points of Entry of Torches in a Multiple Cutting Operation to Prevent Distortion of Steel Plate

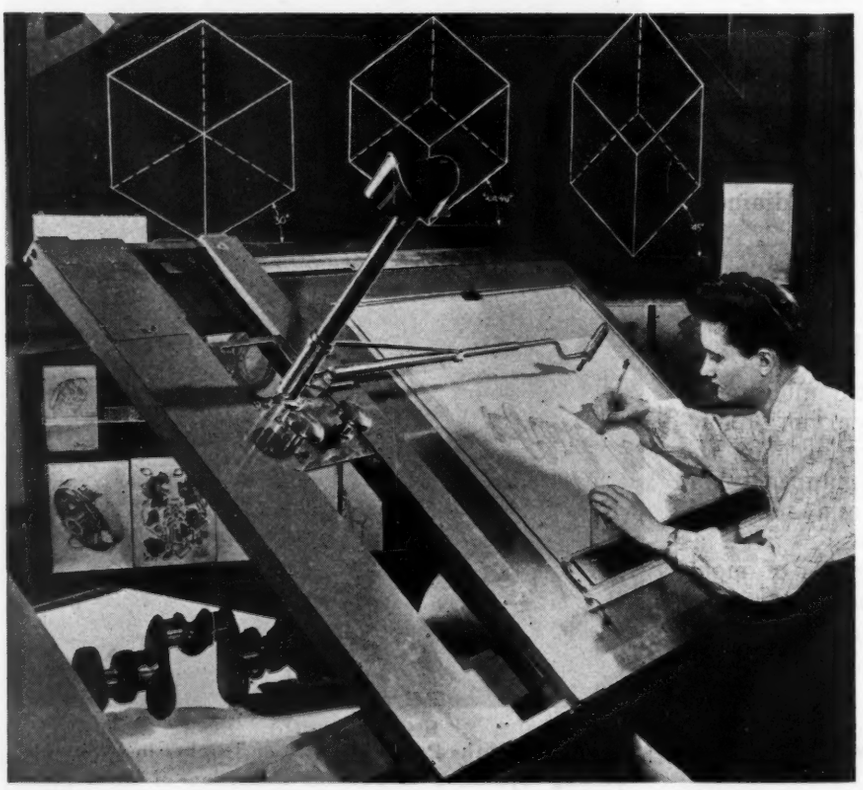
Engineering News

The "Robot Rembrandt"—A New Device Facilitating Drafting-Room Work

A "Robot Rembrandt" that reduces the time required for making certain types of drawings has been developed by the engineers of the Studebaker Corporation. The purpose of the machine is to draw illustrations of actual objects quickly or to convert the image on a blueprint to a single three-dimensional, true-to-scale drawing. In the case of blueprints, the part can be drawn as if viewed from any angle merely by tilting the blueprint to a specified plane and projecting the view by means of the new device.

The apparatus, known as "Sun-Vu," comprises a hooded eye-piece and an electrically actuated pencil point which is mounted inside an arm extending from the base of the eye-piece. The sighting instrument can be moved both horizontally and vertically above an object on the drawing "stage"; its position determines the position of the pencil point over the drawing-board.

The drawings are made by following the contour of the object or design, focussing with cross-hairs in the sighting instrument. Each time the operator centers on a salient point, he presses a control button. The pencil makes a dot on the drawing-board. These dots are later joined and hand shading applied in cases where this is desirable.



Three - dimensional True - to - scale Drawings are Easily Made from Actual Objects or from a Blueprint by Means of the "Robot Rembrandt" Instrument Here Illustrated

Aluminum Adopted for Truck Rear-Axle Housings

A light-weight, heavy-duty truck axle with aluminum housing, hubs, and brake shoes is a development of the Timken-Detroit Axle Co., Detroit, Mich. The axle weighs 220 pounds less than the same unit equipped with malleable iron parts. It is claimed that this weight saving should lengthen tire life considerably, and also improve the riding qualities of the truck, particularly when lighter loads are to be carried at high speeds. The reduction in dead weight will permit trucks to carry more pay load.

Channel of Circulating Water Helps Navy Study Ships' Gear

A miniature ocean in which ships' gear remains stationary while water is forced past it is helping the United States Navy to conduct studies with a view to improving the performance of its fighting ships. Called a "circulating water channel," the latest test unit of the David W. Taylor Model Basin, Washington, D. C., sends 750,000 gallons of water coursing through an upright circular aqueduct and drives it against ships' gear or scaled ship models in a reverse simulation of real ships plowing their way through the ocean.

Two huge motors rated at 1000 H.P., but which can develop up to 1750 H.P. for short periods of time, were especially designed by the Westinghouse Electric Corporation to furnish power for circulating 2800 tons of water in the channel at speeds as high as 12 miles per hour. Surface water is kept flat to permit visibility of undercurrents. Turbulence can be observed from beneath or from either side through plate glass.

The shafts of the motors are connected directly to huge impeller pumps. Giant blades on these pumps, which are located in one of the vertical shafts of

Cutting through 24 Inches of Steel is an Easy Job for This Oxweld Oxy-acetylene Blowpipe. It is Seen Engaged in Cutting up a Hot-top End of a Partially Forged Ingot of Chromium-nickel-molybdenum Steel at a Speed of 3 Inches per Minute

the water tunnel, force water in a continuous flow around the 385-foot long channel. The impeller pumps are equipped with variable-pitch blades to provide different rates of water speed.

Experiments being Conducted on Gas-Turbine Locomotives

The gas-turbine locomotive is likely to be heard from soon. The Westinghouse Electric Corporation has developed a 2000-H.P. experimental gas turbine which could be applied to locomotive service. This gas turbine is only 3 1/2 feet wide by 26 feet long; hence two units can be placed lengthwise in a locomotive, occupying only 26 feet of the length of the engine. Possibly a 4000-H.P. locomotive would need to be only from 40 to 50 feet long. This would be a remarkably compact unit. Diesel-electric locomotives have been in use for some twenty years, but the best that has so far been done is to provide a 3000-H.P. engine in a single cab 90 feet long.

While a gas-turbine locomotive is yet to be built, there are reasonable indications that it will some day become a major competitor in the railway power field. It will burn low-grade, low-cost bunker C petroleum, and if present research work proves successful it may burn coal.

Instrument that Records Presence of Chemical Elements in Materials

A new X-ray photometer which indicates and records the concentration of one chemical element in the presence of others in solids, liquids, or gases has been developed by the General Electric Co. The new instrument, which is non-destructive to most materials, accomplishes this by measuring the change in absorption of X-rays between a sample and a standard.

The X-ray photometer can be used in such applications as determining the ash content of coal, sulphur content of oil, hydrocarbon, chlorine, or fluorine content of plastics, tetraethyl lead content of gasoline, and bromine concentration in certain brominated compounds. The sensitivity of this method of analysis varies from 0.01 per cent to 1 per cent, depending upon the difference in atomic numbers of the components making up the specimens. The X-ray photometer is housed in a standard control cabinet, 72 inches high, 28 inches wide, and 20 inches deep.

Provision is made for several types of test cells, in which the samples are contained, and the liquid and gas cells can be arranged for continuous flow of the materials being analyzed. The new instrument has the features of high speed and continuous operation. No special skill is required to operate the analyzer.

Boilers and Refrigerators Operated by Sun Power

An apparatus is said to have been developed in the Soviet Union that converts solar energy into steam in quantities sufficient for use in canning and chemical plants. The inventor is a Spanish scientist, Federiko Molero. The solar heat boiler has an estimated capacity of 260 pounds of steam per hour. It is mounted above a parabolic reflector about 33 feet wide which collects and concentrates the sun's rays. The inventor is said to have smelted metals with similar equipment.

Another development claimed for Soviet scientists is a solar refrigerator which maintains subzero temperatures even though the outside heat is as high as 98 degrees F. in the shade. The refrigerating appliance consists of a solar boiler and an absorption refrigerator that has no moving parts, with the exception of a small pump that keeps ammonia solution in circulation through a series of hermetically sealed condensing chambers. This appliance is said to produce hot water and artificial ice at the same time.

Editorial Comment

Any method that will promote understanding and reduce friction between employes and management in a manufacturing plant is worthy of serious study. While it is true that much industrial discontent of late has been fostered by the actions and utterances of high Government officials and the agitation of labor leaders, the basic fact remains that where there is thorough understanding between employes and management, the likelihood of labor difficulties is minimized. For this reason, the recent action of William L. Batt, president of S K F Industries, Inc., in arranging for a joint meeting of the union stewards at the Philadelphia plant of S K F and the plant foremen has much to commend it.

A Step toward Real Union-Management Cooperation

Mr. Batt stated that he hoped that meetings of this kind would aid in reducing friction within the plant, just as the company has reduced friction in the equipment of mechanical industries through the production of ball and roller bearings. He pointed out that good relationship between union and management must be provided by the foremen and the union stewards in the plant. He urged upon the foremen, in the case of disagreements, to make the facts of each issue clear, so that a fair solution could be reached, and he urged upon the union to give its best thoughts to the manufacture of a better product at a lower cost. In that way, employes and management can be parties to the success of any enterprise, to the mutual benefit of both sides.

Someone might say that this is like a voice crying in the wilderness, because recent events, unfortunately, have not given proof of much willingness to cooperate on the part of union leaders, even when management has been willing to go more than half way. It is to be hoped, however, that some of the union leaders will accept the opportunity to establish better relations.

Without Industrial Peace, Nobody Can Prosper

At the meeting between the foremen and union stewards sponsored by Mr. Batt, Clinton S. Golden, international vice-president of the United Steelworkers of America, was present and made an address. Mr. Golden pointed out that it was most unusual for the president of a great corporation to take the initiative in suggesting the desirability of a joint meeting of the foremen and stewards, and said he believed that this was a good way to start developing a constructive and cooperative relationship. He expressed the hope that this event would mark the inauguration of new methods in union and management relationships. If both industrial leaders and union officials could generally take this attitude, we would be further on the way toward industrial peace than we now are.

▼ ▼

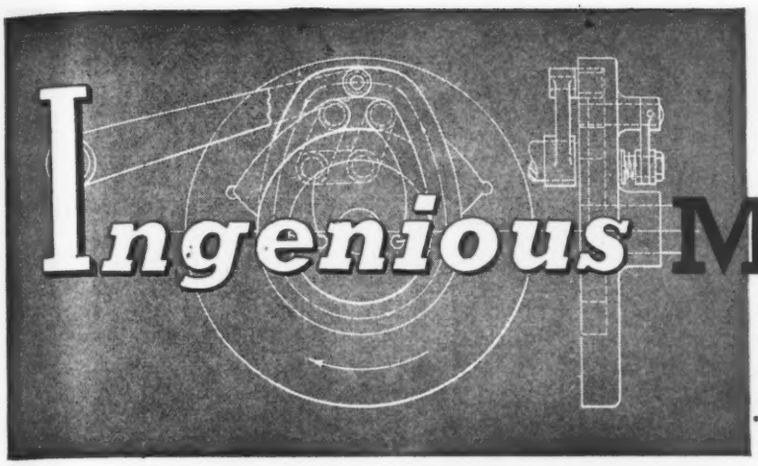
Since accuracy is the watchword of the machinery industries, it may seem odd to suggest that much time and effort are frequently wasted, especially in tool-rooms, by working to too close tolerances where great accuracy is not essential to the proper functioning of a machine or device. Years ago, a skilled and ingenious mechanic said: "It takes an exceptionally good man to know when to slight work."

Needless Accuracy May Add Greatly to Cost of Production

During World War I, for example, the preparations for the effective conduct of the war after the entry of the United States were hampered to a considerable extent by the close tolerances being specified on war material. Inexperienced inspectors at that time also expected manufacturers to follow literally all the dimensional requirements, because they did not have sufficient training to be able to use their own judgment safely. This also suggests the thought that it takes an exceptionally good inspector to know when to slight inspection.

During the war just ended, the experience gained during World War I and during the intervening years of peace and industrial development, prevented the repetition of many of the errors formerly made. There were fewer bottlenecks created by too exacting specifications and unintelligent inspection than there were during the first war.

When accuracy is necessary, there is no excuse for carelessness. Nothing but the best is acceptable. But there is no sense in working to thousandths of an inch on parts that merely "fit in the air." Good judgment and adequate experience must determine in each case just what degree of accuracy is required. That having been decided, the best engineering practice insists on the degree of accuracy determined upon—no more, no less. In that way, unnecessarily high costs can be avoided and time can be saved.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Rotating Disk-and-Pin Mechanism for Controlling Cutter-Head Slide of Automatic Cam-Generating Device

By CHARLES GOLOSMAN

The automatic cam-generating devices shown in Figs. 2 and 3 have incorporated in their designs a rotating disk-and-pin mechanism which can be easily adjusted to machine harmonic-motion cams with any rise, dwell, or diameter in their capacity ranges without the use of a master cam or templet. In many cases the cams can be generated merely on the basis of the calculated values of the rise and fall of the cam, so that there is no need for cam contour drawings.

The rotating disk-and-pin mechanism operating on the principle illustrated diagrammatically in Fig. 1 is employed in the device shown in Fig. 2 to move the milling cutter *A* toward and away from the rotating work *B* as needed to mill or generate a plate cam of the required rise, dwell, and fall characteristics.

The pin *C* in Fig. 2, which is mounted on the rotating disk *D*, transmits the required in and out movement to cutter *A* through contact with a flat hardened steel plate *E* secured to the slide *U* on which the cutter-head is mounted.

The same arrangement of the disk *D* and pin *C* is employed in the device shown in Fig. 3 to move the end milling cutter *A* horizontally to the right and left as needed to mill a cam groove of the required rise, dwell, and fall in the cylindrical cam *G*. The plate *E* on the slide *U* which carries the cutter-head is kept in contact with the actuating pin *C* by means of a cable and weight attached to

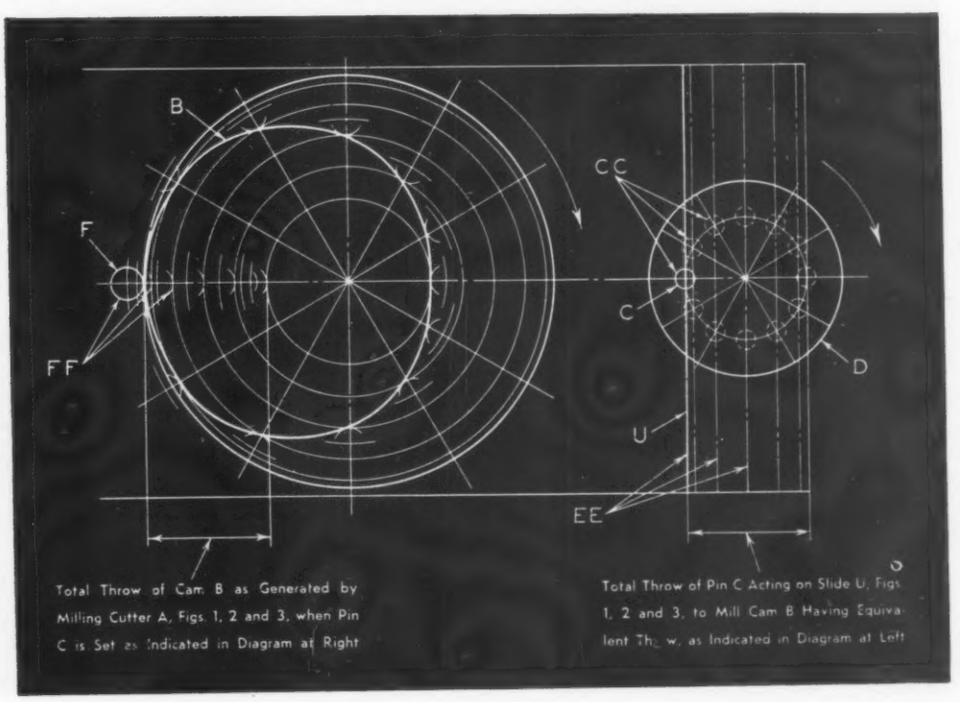

B
F
FF
CC
C
D
U
EE
Total Throw of Cam B as Generated by Milling Cutter A, Figs. 1, 2 and 3, when Pin C is Set as Indicated in Diagram at Right
Total Throw of Pin C Acting on Slide U, Figs. 1, 2 and 3, to Mill Cam B Having Equivalent Throw, as Indicated in Diagram at Left

Fig. 1. Diagrams Illustrating Operating Principle of Rotating Disk-and-pin Mechanism Employed in Cam-generating Devices Shown in Figs. 2 and 3. Cutter A, Fig. 2, is Indicated as F in the Diagram at the Left. The Diagram at the Right Shows Pin C Mounted in Disk D and Its Consecutive Positions CC as It Rotates in a Circle. The Corresponding Consecutive Positions of Cutter F as It Generates Cam B are Indicated at FF. Consecutive Positions of Slide U are Indicated at EE. The Harmonic Motion Transmitted by Pin C to Slide U, which, in Turn, Transmits Harmonic Motion to Cutter F, Generates the Required Harmonic Rise and Fall Profile on Cam B

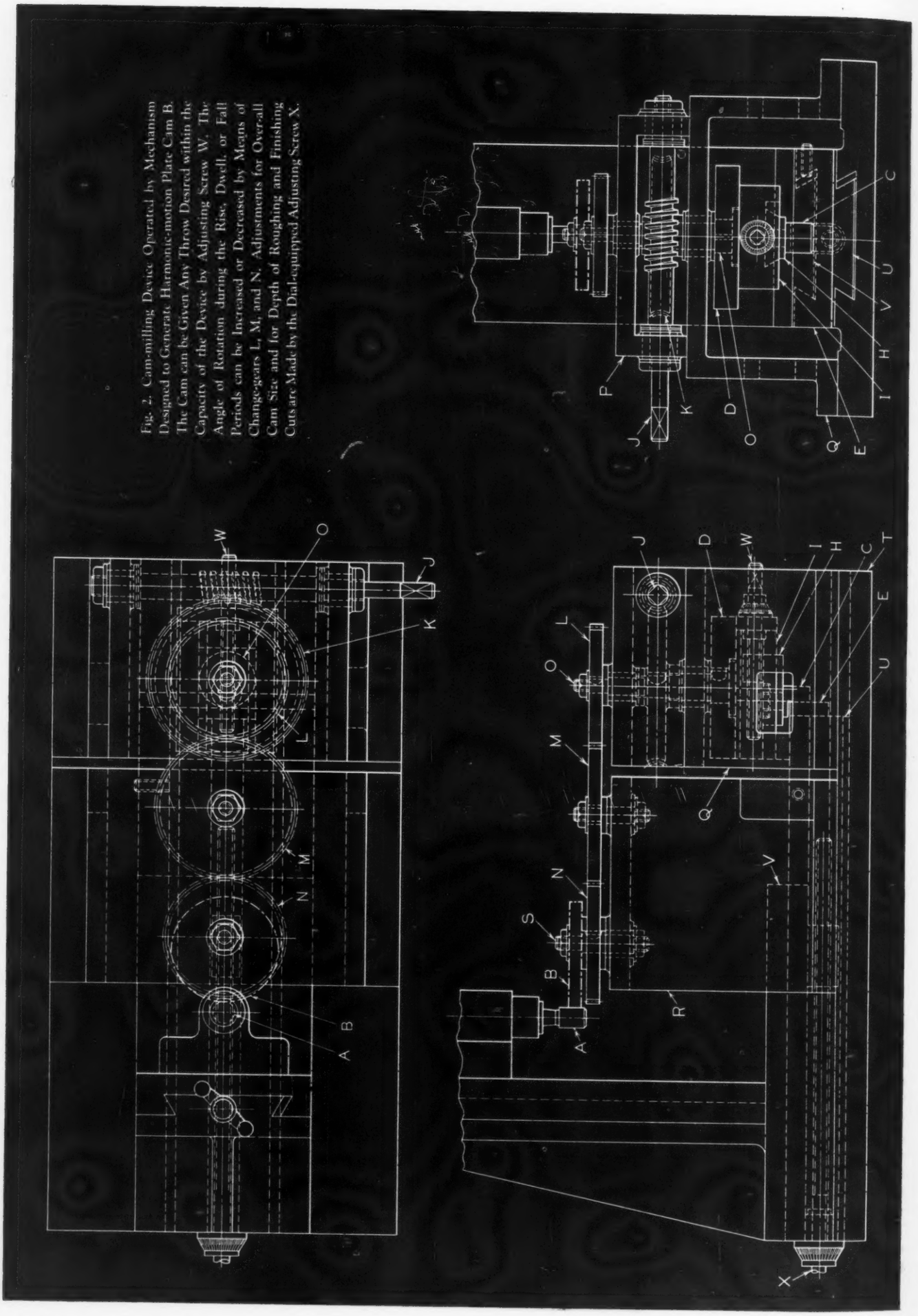


Fig. 2. Cam-milling Device Operated by Mechanism Designed to Generate Harmonic-motion Plate Cam B. The Cam can be Given Any Throw Desired within the Capacity of the Device by Adjusting Screw W. The Angle of Rotation during the Rise, Dwell, or Fall Periods can be Increased or Decreased by Means of Change-gears L, M, and N. Adjustments for Over-all Cam Size and for Depth of Roughing and Finishing Cuts are Made by the Dial-equipped Adjusting Screw X.

the rear end of the slide base (not shown in the illustrations).

Referring to Fig. 2, the pin *C* (also shown in the diagram Fig. 1) is flattened on its working end to a semicircular shape, and is free to rotate in slide *H*, mounted in guide block *I*. The guide block is secured to disk *D* (see Figs. 1 and 2) and can be set by means of slide *H* and its adjusting screw *W* to any distance from the center of disk *D*, thus determining the throw of the cam to be machined.

The harmonic motion is obtained by turning disk *D*, and thus rotating pin *C* in a circle, the radius of which is determined by means of slide *H*. The flat side of pin *C* in contact with the flat hardened plate *E* causes slide *U*, which carries the cutter-spindle head, to advance or recede longitudinally with harmonic motion.

Disk *D* is driven by means of worm *J* and worm-wheel *K*. If desired, a small electric motor can be installed to drive worm *J*. The rotating movement of disk *D* is synchronized with that of the cam blank *B* by means of a gear train consisting of change-gears *L*, *M*, and *N*. Gear *L* is mounted on the vertical worm-gear shaft *O*, which also carries disk *D*, together with slide guide block *I*, slide *H*, and pin *C*.

Worm-gear shaft *O* is mounted in bearings inserted in upper and lower rear bridges *P* and *Q*. Intermediate gear *M* is held on a stud inserted in the bridge *R* which supports the work-holding stub spindle *S*. The driven gear *N* is mounted on spindle *S* and secured to it by a key. The spindle *S* also carries the blank cam *B*. Spindle *S* turns in a bearing in bridge *R*. The upper rear bridge *P* is secured to the lower bridge *Q*. Bridge *Q* and bridge *R* are fastened directly to base *T*. The base slide *U* carries a compound slide *V* having a vertical bracket on which the cutter-spindle head is mounted.

The procedure of setting up the device for machining a cam is as follows: Let it be assumed that a plate cam of 1/2-inch harmonic-motion rise in 180 degrees and 1/2-inch harmonic-motion fall in the remaining 180 degrees is to be machined. Assume also that the cam is to have a base circle 1 1/2 inches in diameter. The first step is to set slide *H* by means of adjusting screw *W* so that the flat side of pin *C* is 1/4 inch from the center of disk *D*. This setting will give the cam a total throw of 1/2 inch. Mount the change-gears *L* and *N* on their respective shafts *O* and *S*, and place the intermediate gear *M* on the idler gear stud. (In this case where the cam is to have a 180-degree rise and a 180-degree fall, the change-gears *L* and *N* will have the same number of teeth.) Next mount the cam blank *B* to be machined on the stub spindle *S*. The compound slide *V* carrying the cutter-spindle head is then set, by means of adjusting screw *X*, for taking a roughing cut at a distance from the center of the cam blank equal to the radius of the base circle plus the total throw of the cam plus the allowance for the finishing cut.

When disk *D* completes a full revolution, the cam blank *B*, rotated through gears *L*, *M*, and *N*, will also make a complete revolution. The 1/2-inch rise on the cam blank during the first 180 degrees of rotation and the 1/2-inch fall during the remaining 180 degrees of rotation of the cam blank are obtained by the harmonic displacement of base slide *U* through the action of pin *C* in disk *D*. The compound slide *V* and the cutter-spindle head are mounted on the base slide *U*, as shown in the end view to the right in Fig. 2. After taking the roughing cut, the cutter is set by means of screw *X* to take the final cut, which finishes the cam to the correct size.

Should it be desired to complete the rise of the cam in a portion of the revolution other than 180 degrees as, say, in 90 degrees, then the ratio of the change-gears *L* and *N* must be changed accordingly. In this case, driven gear *N* will be required to have twice as many teeth as the driving gear *L*, so that the cam blank would make only 1/4 of a revolution, or 90 degrees, while disk *D* and the driving gear complete 1/2 a revolution, or 180 degrees rotation, as required to displace base slide *U* and the cutter-spindle head a distance equal to the throw of the cam with a harmonic acceleration and deceleration motion.

Thus the ratio of the change-gears *L* and *N* may be determined as follows:

$$\frac{\text{No. of Teeth } N}{\text{No. of Teeth } L} = \frac{180 \text{ degrees}}{\text{No. of degrees required for rise or fall of cam}}$$

The machining of the fall portion of the cam lobe is completed with the same gear ratio set-up by rotating disk *D* through the remaining 180 degrees (if the fall of the cam also takes place during the rotational movement of 90 degrees), thus bringing pin *C* back to its starting dead-center position.

It should be noted that if the rise or fall of the cam lobe is completed in less than 180 degrees rotation, the cut must be started on the low point of the cam (set pin *C* on its dead center farthest from the end of the base slide); otherwise, it would be necessary to reverse the direction of rotation of disk *D* to complete the fall of a given cam lobe.

If the cam to be machined is designed with a dwell on a certain portion of its periphery, then, as the starting point of the dwell is reached, the worm drive of disk *D* is disengaged, the base slide *U* is locked with clamping screws so that the slide and cutter-spindle head will remain fixed in this position, and pin *C* is brought to the center of disk *D* by means of adjusting screw *W* and its graduated scale. The worm drive of disk *D* is then reengaged for machining the desired dwell portion of the cam concentric with the cam-spindle axis.

The automatic cam-generating device arranged for milling a cylindrical cam with harmonic rise and fall shown in Fig. 3, as previously mentioned, operates on the same principle as the plate-cam milling device. It differs only in that portion of its construction designed to accommodate the cam.

Fig. 3. Cam-milling Device Similar to One Shown in Fig. 2, but Equipped for Milling Cam Grooves in Cylindrical Cams Such as Shown at G. Means for Adjusting Device to Cut Harmonic-motion Cam Grooves of Any Rise, Fall, or Dwell within Its Capacity are Provided, as in the Case of the Plate Cam-milling Device Shown in Fig. 2. The addition of a Cross-slide and Its Adjusting Screw XX Provides Means for Controlling the Depth of the Cam Groove

Two bevel gears *L* and *M* are introduced in the gear train to synchronize the movement of disk *D*, carrying pin *C*, with the movement of the headstock spindle *S* which carries the arbor on which the cam blank *G* is held.

The cutter-spindle head *Y* is mounted horizontally on cross-slide *Z*, which is guided in cross bridge *VV*. Cross bridge *VV* is fastened to longitudinal compound slide *V*. Headstock *AA* and tailstock *BB* are secured rigidly to bridge *CC*, and the cam blank is mounted on an arbor held between centers. Disk *D* is driven, as previously described, by worm *J* and worm-gear *K*. The harmonic-motion rise and fall of the cam obtained by the harmonic displacement of base slide *U* carrying the cutter-spindle head *Y* are secured by means of pin *C* in the rotating disk *D*, as in the case of the plate-cam milling device shown in Fig. 2. The gear train for the cylindrical-cam milling device consists of a pair of bevel gears *L* and *M* and spur gears *MM* and *NN*. The setting of pin *C* for the throw of the cam to be machined and the selection of the proper gear ratio for obtaining the desired periods of rise and fall of the cam are effected in the same manner as when machining plate cams. The required dwell is also obtained similarly.

Back-gear J is Automatically Engaged or Disengaged as the Torsional Resistance of Shaft Q Increases or Decreases

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Automatic Back-Gear Shifter

By W. F. MAC GLASHAN, JR.

A device for automatically shifting a back-gear in and out as the torsional resistance of a shaft varies is shown in the accompanying illustration. This mechanism is a part of an automatic drill-press feeding device. Shaft *Q* is connected to the drill-press feed-spindle through an adjustable slip clutch (not shown), and motor-shaft *A* is the source of power. The automatic shifting of the back-gear permits the use of a small motor to deliver the high thrust necessary at the drill point for drilling large holes, and at the same time permits rapid traverse of the drill to and from the work. The back-gear is automatically disengaged for drilling small holes.

Hub *B* is keyed to input shaft *A*. Cantilever leaf springs *C*, attached to hub *B*, are under sufficient initial strain to transmit full torque through spherical-ended pins *D* without slippage. Collar *E*, gear *H*, and worm *N* are pinned to shaft *F*. Cluster gear *J*, which is supported in frame *M*, is in constant mesh with gear *H* and idler gear *G*. Worm-gear *P* is pinned to shaft *Q*. The thrust collar *K* floats on shaft *F* and supports the compression spring *L*.

At the start of the cycle, input shaft *A* drives shaft *F* at the same speed through the gripping action of pins *D* on collar *E*. During this time, gear *G*, which is a sliding fit on shaft *F*, is idling at high speed. When the reaction of worm *N* to the torsional resistance of shaft *Q* builds up sufficiently to overcome the load exerted by spring *L*, shaft *F* will shift axially to the right. Thus pins *D* will transfer their torque from collar *E* to the hub of idler gear *G*, thereby transferring the drive through the cluster gear *J*, or back-gear, to shaft *F*. The back-gear is automatically disengaged upon the reversal of the input shaft *A*.

On this particular mechanism, the input shaft delivers 1/12 H.P. at 1500 R.P.M. Gears having 24 pitch furnish a 4 1/2 to 1 reduction through the back-gears. Pins *D*, collar *E*, and the hub of gear *G* are hardened. The initial load on spring *L* must be set lower than the minimum worm reaction to prevent pins *D* from dwelling at the parting line of collar *E* and gear *G*.

* * *

Drop Forging Association Elects Officers

At the eleventh annual meeting of the Drop Forging Association, with headquarters in Cleveland, Ohio, the following officers were elected: President, Roland J. Ahern, president of the Billings & Spencer Co., Hartford, Conn.; and vice-president, Ralph A. Mitchell, vice-president of the Pittsburgh Forgings Co., Coraopolis, Pa. R. M. Seabury, who has served continuously for eleven years as secretary-treasurer, was re-elected to that office, and Holloway Kilborn was re-elected assistant secretary-treasurer.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Material for High-Strength Clutch Plate

N. R. B. — In a double-plate type friction clutch used in heavy-duty vehicles, trouble has been encountered with cracking of the intermediate plate. This plate is 14 inches outside diameter by 6 1/2 inches inside diameter by 1 1/8 inches thick, and is made from cast iron. Breakage could, of course, be avoided by making the plate of steel or malleable iron, but the strength would be gained at the expense of other qualities inherent in cast iron which make it desirable for this application—that is, wear resistance and dimensional stability. Could you recommend a cast-iron composition that would not be subject to this type of failure?

Answered by Editor "Nickel Cast Iron News"
International Nickel Co., Inc., New York City

We would recommend an iron possessing a minimum strength of 50,000 pounds per square inch. Such an iron would have the following composition: Total carbon, 2.9 to 3.1; silicon, 1.8 to 2.0; manganese, 0.5 to 0.8; nickel, 1.25 to 1.75; chromium, 0.1 to 0.3; molybdenum, 0.3 to 0.5 per cent.

Compositions of this kind are being used for brake-drums and similar wear-resisting applications. This iron possesses a higher degree of toughness than ordinary cast irons, thus making it suitable for the application in question.

Service Guarantees for Equipment

P. F.—Is a manufacturer legally liable for so-called "service guarantees"?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

Recent higher court decisions hold that where a seller fails to carry out an agreement to keep an appliance in repair after he has guaranteed that he personally will keep the apparatus in repair, the purchaser is entitled to rescind the contract and recover the purchase price. In the case of May, 159 Md. 605, the seller sold and guaranteed an appliance. The seller agreed to keep it in repair for a year, but he failed to do so. The Court held that the buyer could either have the device serviced or repaired for one year at the seller's expense and deduct this expense from the contract price or he could sue the seller and recover the purchase money which had been paid.

In this case, the Court explained that where a seller personally guarantees to keep an appliance in repair for a stated period and fails to do so, the purchaser is entitled to rescind the contract and recover the full purchase price, and the seller must take back the appliance.

For comparison, see Welkner v. Di Carlo [27 A. (2d) 351] reported July, 1942; here the contract provided that the appliance had been "completely reconditioned, service guaranteed one year free." There was no guarantee of the quality, except that it was "completely reconditioned," and the service was "guaranteed" for one year. After the purchaser had had the appliance for several weeks, he discovered that it was defective and needed repairs. The seller refused to repair it and the purchaser filed suit.

The higher court held that the purchaser was obligated to pay the full purchase price for the apparatus, but that he could deduct from the contract price the total expenses incurred in making needed repairs. The Court said that where a seller does not guarantee that he personally will make the repairs, the purchaser must make the repairs and the seller must pay the repair bills.

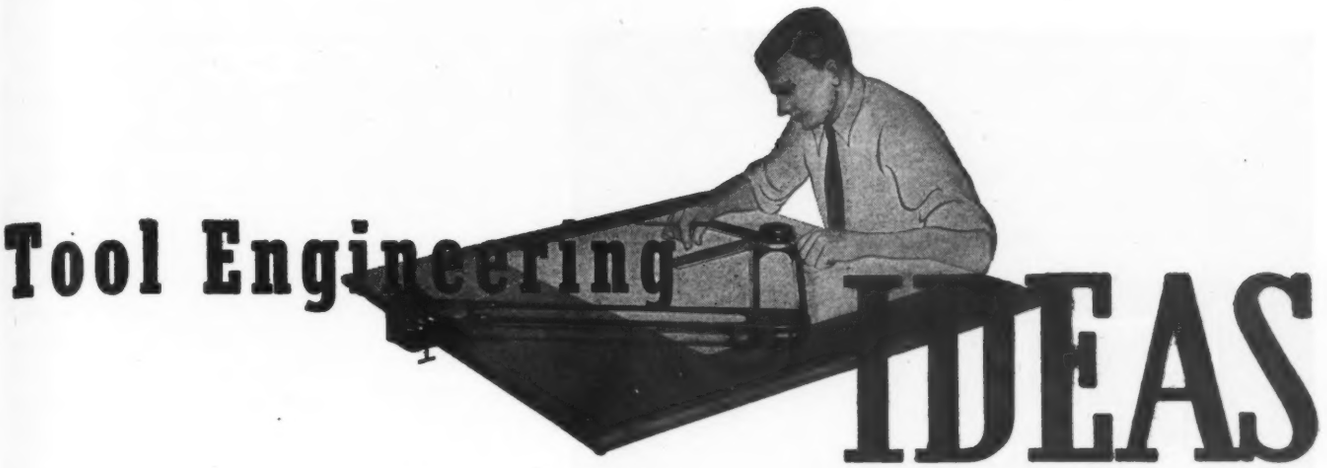
* * *

New Mechanical Finishing Process

A new method of producing a semi-bright finish mechanically, known as "Britehoning," has been developed by the Sturgis Products Co., Sturgis, Mich. This process is especially intended for small stampings, forgings, machined and extruded parts, die-castings, and sand castings. It is basically a tumbling method involving the use of mineral chips and suitable compounds for developing a fine semi-lustrous finish on practically all types of metal. The new process is well suited for finishing small zinc-base die-castings or brass stampings preliminary to bright nickel or chromium plating. Steel and aluminum parts are also advantageously finished.

The parts to be finished can be subjected to the process directly after the forming or trimming operation, provided the die marks do not penetrate too deeply into the surface. Die-castings, if closely trimmed, may be processed as received from the trimming die, but if the trimming is not close, a polishing wheel or abrasive belt operation may be necessary prior to "Britehoning."

The results obtained by "Britehoning" are said to be uniform, and the process can be handled by semi-skilled labor. The process has already been used commercially in the automotive industry and in the hardware and plumbing fields.



Double-Acting Attachment Permits Deep Drawing on a Single-Acting Press

By FRED B. MONEY, Superintendent, Forge Shop
Baldt Anchor, Chain & Forge Co., Chester, Pa.

A device for accomplishing double-acting, deep drawing on an ordinary single-acting press is described in the following. Metal parts of relatively large size can be deep drawn rapidly and economically by this method. For example, large quantities of hemispheres, 19 inches in diameter, have been drawn from unheated steel disks, 30 inches in diameter by 3/16 inch thick, at a sustained production rate of sixty pieces per hour.

A steel cup 7 1/4 inches in diameter by 3 5/8 inches deep is a typical example of deep drawing that is frequently encountered. This job can be easily handled with the attachment described. The blank for this cup, which is 11 1/2 inches in diameter by 1/8 inch thick, is shown at the left in Fig. 1, together with a rough cup, and a finished, trimmed piece is shown at the right. There is very little reduction in the thickness of the metal through any section of this cup. Thousands of these cups have been drawn by means of this attachment on a single-acting press at a rate of 225 cups per hour.

Details of this attachment, which was adapted to a single-acting forging press for drawing the cups just described, are shown in Figs. 2 and 5. As the ram *R* and die *D* descend, the periphery of the metal blank *M* is gripped between the polished and lubricated faces of the die and the floating

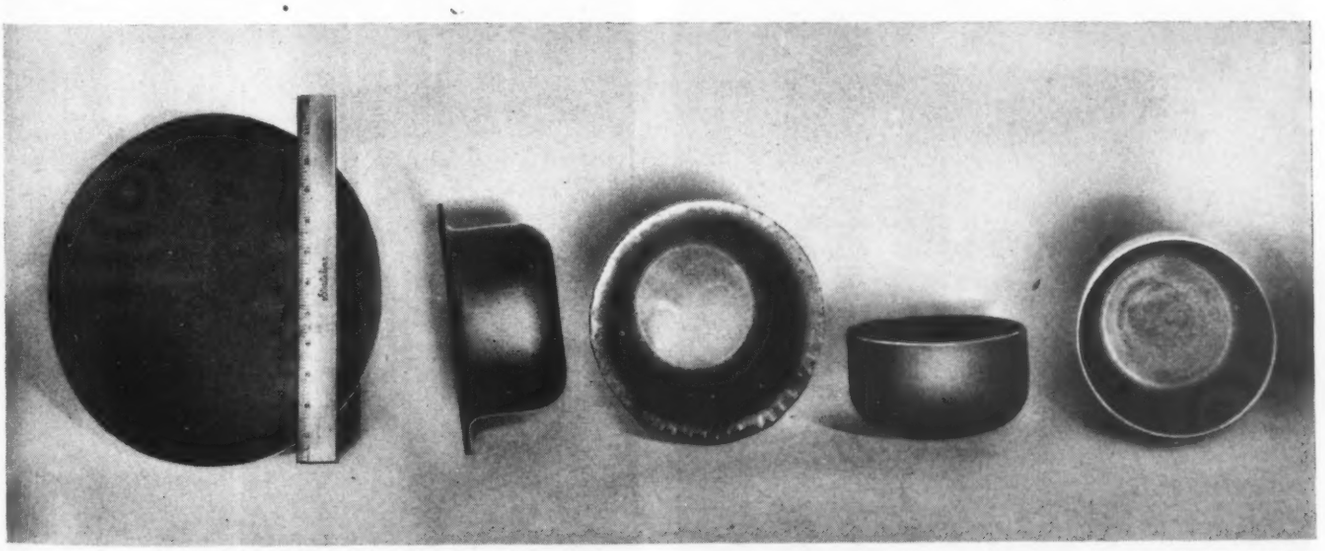


Fig. 1. Successive Steps in the Drawing and Trimming of the Finished Cup Shown at the Right. The Blank Shown at the Left is 11 1/2 Inches in Diameter by 1/8 Inch Thick. This is a Typical Example of Work that can be Produced with a Double-acting Attachment on a Single-acting Press

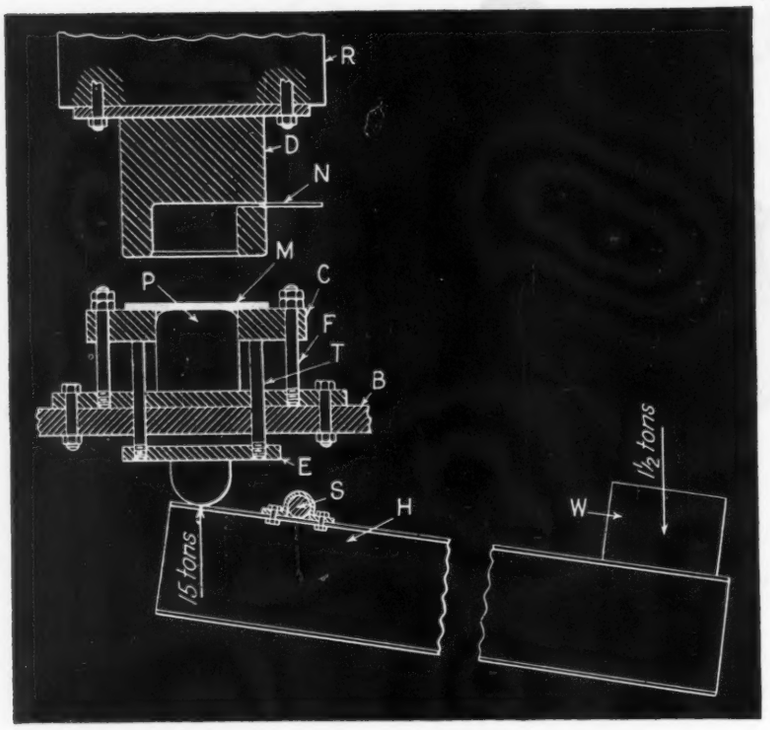


Fig. 2. Schematic Cross-section of a Double-acting Attachment for Single-acting Presses, with the Die Shown in the Open Position

clamping plate *C*. The pressure exerted by the clamping plate is due to the weight *W*, which in this particular case is 1 1/2 tons, acting through the 10-inch H-beam *H*. This beam is pivoted about shaft *S*, and is of sufficient length to exert an upward pressure of fifteen tons on the thrust platen *E*. This pressure, which is constant throughout the operation, prevents the periphery of the blank from becoming unduly wrinkled during the draw.

The pressure on the periphery of the blank is controlled to permit horizontal slippage and gradual withdrawal of the metal from between the gripping surfaces as the die continues to descend. The blank is forced into the die by, and assumes the shape of, the punch *P*. The

Fig. 3. Another View of the Double-acting Attachment Illustrated in Fig. 2, with the Deep-drawing Die Shown in the Open Position

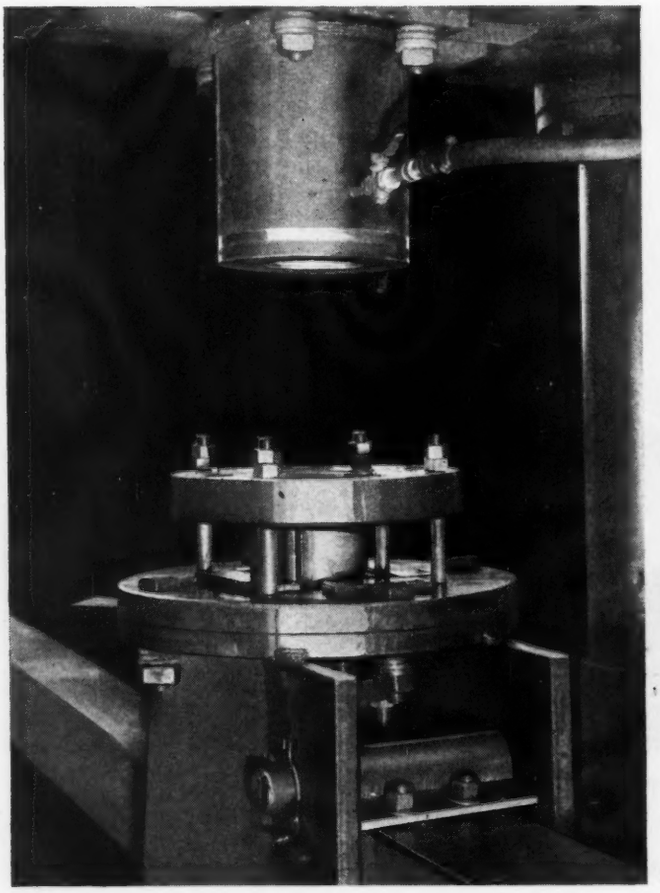
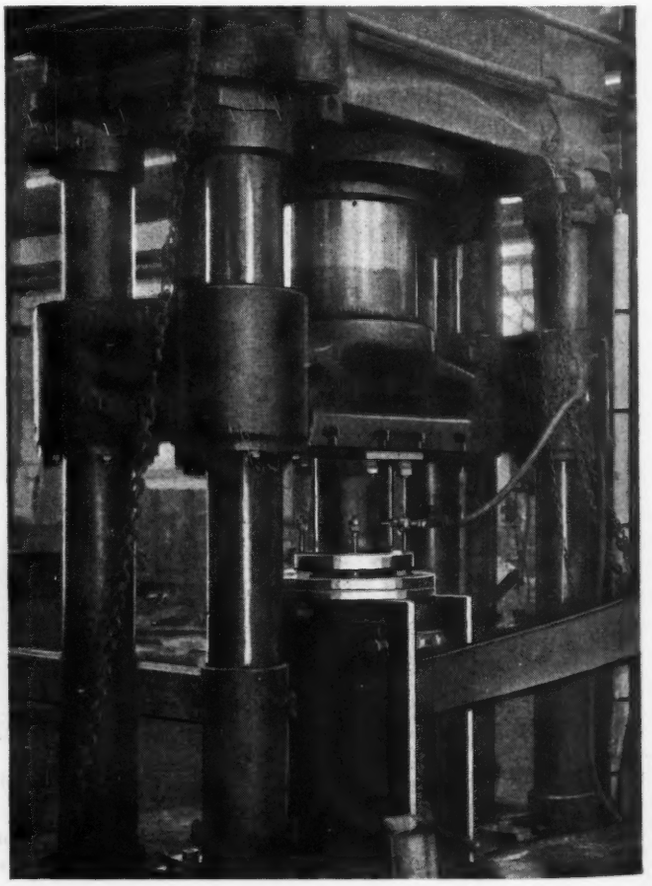


Fig. 4. The Double-acting Attachment is Shown Here Mounted on a Single-acting Forging Press with the Die Shown in the Closed Position



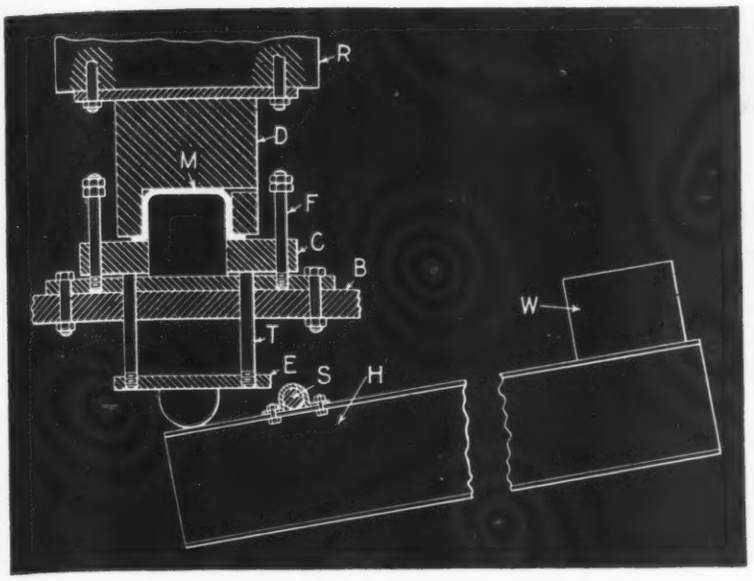


Fig. 5. The Closed Position of the Die in the Same Set-up as Shown in Fig. 2. Metal Cup M has been Completely Drawn

completion of the press stroke is shown in Fig. 5. Retraction of the press ram permits the weight to descend to its original position, thus automatically raising the clamping plate and stripping the cup from the punch.

The clamping plate is guided during its floating motion by bolts *F*, and is connected to the thrust platen by thrust rods *T*. The punch is bolted to the press bed *B*. An air blast from nozzle *N* is used to eject any cups that might stick in the die.

The die is shown in Fig. 3 in the open position, prior to loading. The completion of the stroke is illustrated in Fig. 4. The weight may be increased, decreased, or shifted on the beam, according to the pressure desired. For higher pressures, beams and weights may be symmetrically paired on opposite sides of the die.

General-Purpose Jig for Drilling Small Levers

The jig illustrated was designed for use in drilling taper-pin or set-screw holes in a variety of small levers which differed slightly in shape and in the method of attachment to their mechanisms. The body casting *A* carries an adjustable drill plate *B*, which is held in the required position by two clamping bolts *C*. One of these bolts is screwed into the body casting to form a pivot, and the other can be positioned in a radial slot to provide the necessary adjustment. The various sizes of drills or reamers used are accommodated by interchangeable bushings at *D*.

The levers are located by means of interchangeable arbors *E*, which have their outer ends made to suit the main bores of the various levers and their inner ends machined for insertion in the hardened liner *F*. The arm of the lever is supported by the pin *H*, which can be adjusted in the slot *J*. The interchangeable collar *K* has a V-shaped groove in it to give positive location for round levers. The collar is bored eccentric to permit adjustment of the location groove to accommodate levers of various diameters. Slip washers *G* and *P* facilitate changes in set-up. A key *L* machined on the under side of the head of pin *H* prevents the pin from turning. Stud *M* and heel-pin *N* permit the use of a clamp when required.

* * *

A New Development in Railroad Locomotive Diesel Engines

A new type of railroad locomotive Diesel engine is now being tested by the engineering department of the Cooper-Bessemer Corporation, Mount Vernon, Ohio. It is said that the new engine delivers 40 to 50 per cent more horsepower than any other engine having similar displacement ever made by the company. The new engine weighs less per horsepower and occupies less space than engines previously produced by the company, and promises to afford greater fuel economy than has ever before been attained by a Diesel engine. Details as to design of the new engine are not yet available, since shop tests will be continued for several months to come. Later, the engine will be tried out in several operating installations before it will be generally available. It is understood, however, that the increased horsepower is partially attributable to new developments in the field of supercharging.

Jig for Drilling an Assortment of Small Levers

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Self-Emulsifying Solvent Utilizes "Constant-Float" Protection

A self-emulsifying, water-mixable solvent—"Oakite Composition No. 98"—that removes light shop dirt and non-pigmented stamping compounds from steel and aluminum work has been made available by Oakite Products, Inc., 26 Thames St., New York 6, N. Y., for use primarily in pressure-spray washing machines. It is non-toxic, and non-flammable in solution.

The new material is reported to have important self-cleaning properties, and employs the principle of "constant-float" protection. The lighter-than-solution soil floats at the top of the cleaning tank, protecting the clean solution underneath, retarding foaming, and preventing material loss by evaporation. The "floating layer" is periodically skimmed off or caused to overflow, in order to avoid excessive thickening. The new solvent also prevents formation of water spots, which often show through clear lacquer and similar finishes. 201

Even Distribution of Free Carbides Improves High-Speed Steels

A major improvement in the quality of high-speed steels, achieved by a more even distribution of free carbides, has been accomplished through a "Desegatizing" process developed by the Latrobe Electric Steel Co., Latrobe, Pa. The purpose of this process is to prevent the segregation of free carbides in a brittle mass near the center of high-speed steel bars and other shapes. Such segregation produces a non-uniformity in the steel structure, and is, therefore, a source of weakness.

The tool-steel bars and other shapes produced by this process are called "Desegatized" steel. In performance, "Desegatized" steel shows uniformly superior results under heat-treatment; longer tool life; longer run between grinds; minimum warpage and breakage; and more consistent tool performance. 202

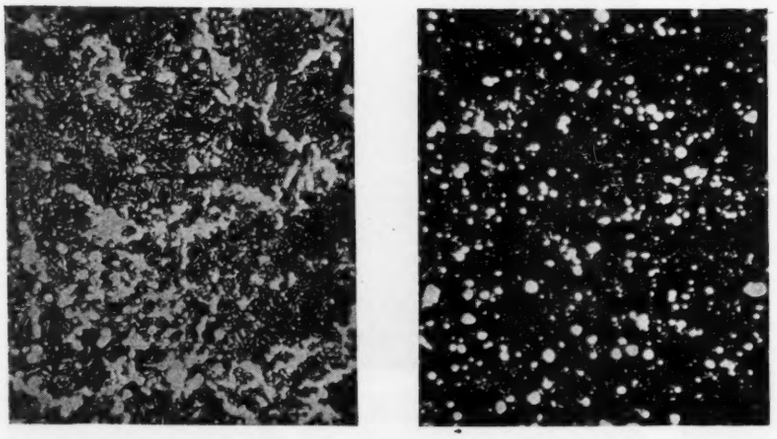
Thermoplastic Air-Drying Coating for Plating-Rack Protection

A rack coating designed specifically to overcome the difficulties commonly found in applying lacquers to electroplating racks has recently been announced by the Michigan Chrome & Chemical Co., 6340 E. Jefferson Ave., Detroit 7, Mich. Known as "Miccrotex," this new air-drying rack coating is a thermoplastic insulating material which meets the requirements of all plating, anodizing, tannerizing, Parkerizing, and bonderizing cycles.

It is tough, resilient, and flexible, and is unaffected by any solution commonly used in plating and anodizing cycles, including the electrolytic sulphuric acid strip employed to dissolve bright nickel, and alkaline cleaners at boiling temperatures. The only exceptions are some of the organic solvents used in vapor degreasing. The coating can be applied by dipping, brushing, or spraying, depending upon the construction of the rack. ...203

Cleaning Compound for Flexible Abrasives and Metal Files

A compound called "Sand Re-nu" has been developed by the Massie Mfg. Co., 558 Fortieth Ave., N.E., Minneapolis 13, Minn., for removing pitch,



(Left) Central Structure of a Standard 18-4-1 High-speed Steel Bar. (Right) Similar Section of 18-4-1 High-speed Steel Bar that has been "Desegatized." The Difference in Segregation of Free Carbides is Readily Apparent. (Magnification 500 X)

To obtain additional information on materials described on this page, see lower part of page 234.

resinous substances, and metal embedded in sandpaper, emery cloth, and metal files. Flexible abrasive belts and metal files are cleaned by soaking in a solution of "Sand Re-nu," while solid wheels, buffing wheels, and disks are treated by brushing the liquid on the abrasive surfaces. The accumulated foreign material is removed with a steel brush or file card after the soaking period. The solution has no corrosive effect on machinery, is non-toxic, and non-combustible. 204

Improvements in Molding Technique Widen Mycalex Applications

Advances in injection molding processes are expected to greatly increase the number of peacetime applications of Mycalex—a stone-like product composed of ground mica and a special glass—which is made by the General Electric Co., Pittsfield, Mass. The consequent reduction in tool costs for molding this material make possible its extensive use in such products as rotating equipment, control equipment, heating devices, motor parts, and welding equipment. 205

Plastic with Unusual Resistance to Acids and High Temperatures

A plastic that withstands acids which dissolve gold and platinum and retains its strength and form at higher temperatures than any known organic material has been announced by E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. This new material is already an important factor in such new developments as the jet engine, and is said to be the only plastic that will stand up under the high temperatures incident to this service. It is also being used in radar and television fields.

This plastic material—tetrafluoroethylene resin—to be known by the trademark "Teflon," was manufactured for special military uses during the war, and is now available in limited amounts in the form of sheets, rods, tubes, coated wire, tape, and fabricated sections for experimental purposes. Difficulty in fabrication and high cost of manufacture are conditioning factors in its present stage of development.

It is expected to find industrial use where unusual resistance to solvents and corrosive agents is required, where heat endurance is of paramount importance, and where insulation against high electrical frequencies is needed, in combination with one or both of these properties. Such potent reagents as aqua regia, chlorosulphonic acid, acetyl chloride, boron trifluoride, hot sulphuric acid, hot nitric acid, and boiling solutions of sodium hydroxide do not affect the polymer. Subjected to a temperature of 572 degrees F. continuously for three months in a recent test, it showed virtually no degradation and retained all its useful properties at that elevated temperature. Conversely, it is not adversely affected by temperatures as low as 75 degrees F. below zero. 206

Inks for Marking Plastics, Rubber, and Insulated Wire

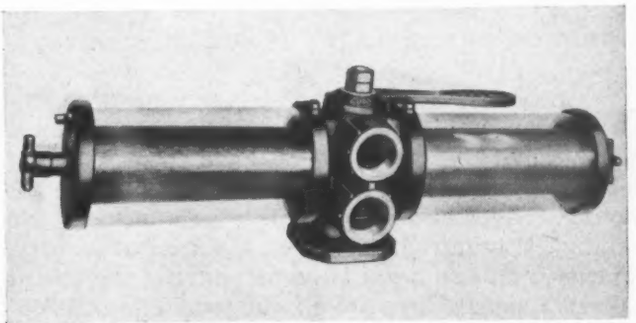
Several new inks have been placed on the market by the Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J., for trademarking and imprinting plastics and rubber (both natural and synthetic), as well as for marking enamel, lacquer, plastic, and rubber wire insulations. The liquid inks are applied by hand or machine in standard liquid type ink fountains, while the paste inks are also applied by hand or mechanical means, using standard ink feeds..207

Rust-Preventing Compound for Short-Period Protection

A rust-preventing agent known as "Pennsalt RI-50," for use in water solution on ferrous metals before they are painted or enameled, and between machine operations, has been brought out by the Pennsylvania Salt Mfg. Co., Widener Bldg., 1335 Chestnut St., Philadelphia 7, Pa. This compound is an inorganic salt mixture designed to protect ferrous metals for short periods. It requires no rinsing before painting. 208

Plastic Coating for Protecting Metal Products

A plastic coating that is tough, moisture-proof, and resistant to salt water, developed originally for the Army Air Forces to protect planes on the decks of freighters and tankers during shipment over-



Lucite Provides a Transparent Casing for Duplex Pipe-line Strainer, Making It Possible to Determine by a Quick, Visual Inspection when Strainer Units Need Cleaning

To obtain additional information on materials described on this page, see lower part of page 234.

seas, is now available for peacetime use. This coating, called "Kotol," which is manufactured by the Naugatuck Chemical Division of the United States Rubber Co., Naugatuck, Conn., is expected to find applications in the protection of machine parts during shipment and as a rack coating and stop-off lacquer for the electroplating industry.

It has a tensile strength of 900 pounds per square inch, and maintains its protective qualities over a wide temperature range. It is flexible at minus 40 degrees F. and shows good aging characteristics at 180 degrees F. Kotol is applied by spraying or dipping, and is dried either by air or by baking at 250 degrees F. 209

Centrifugally Cast Aluminum-Bronze Bushing Stock

A tough centrifugally cast aluminum-bronze bushing stock known as Torrance standard bronze and produced by the Torrance Brass Foundry, 1825 W. 213th St., Torrance, Calif., is now being made available to machine shops and manufacturers with limited stock requirements. During the war, it was used extensively in the aircraft, automotive, ordnance, and maritime industries by large consumers having Government contracts.

Centrifugal casting insures maximum density, uniform grain structure, and absence of inclusions. The Torrance process produces castings that are concentric and have no draft, so that "clean up" is reduced to a minimum. 210

Two Saran Coating Materials Provide Moisture-Vapor Protection

Saran F-120—a solvent soluble resin imparting very low moisture-vapor transmission—and Saran F-122—a latex forming a continuous film upon air drying—are two new coating materials produced by the Dow Chemical Co., Midland, Mich.

Saran F-120 resin produces extremely dense, impervious coatings, completely waterproof and more moisture-vapor-proof than organic coatings. It is said to represent the closest approach to metal foil, from the point of view of moisture protection, to be found among the commercially available soluble synthetic resins. Coatings based on this new resin are further characterized by a high degree of resistance to solvents, oils, greases, acids, and alkalies. They will not support combustion; are odorless, tasteless, and non-toxic; and can be produced with varying degrees of flexibility and hardness.

Saran F-122 latex coatings have properties similar in most respects to those of the solvent soluble Saran polymers. They are designed for easy application from an entirely aqueous system. Upon air drying, tough, clear, glossy films are formed. No baking is required, and costly solvent recovery, toxicity, and fire hazards accompanying the use of solvent type coatings are eliminated. The inherent resistance of Saran to water, greases, oils, and a large variety of solvents and chemicals has been preserved in this latex form, thereby permitting a wide variety of uses. Although Saran latex coatings are waterproof, they do not provide as high moisture-vapor protection as the solvent-applied Saran coatings. 211

Aluminum Alloy Combines Strength and Free Machining Properties

A new product is being produced by the Reynolds Metals Co., Aluminum Division, 2500 S. Third St., Louisville, Ky., which is essentially an aluminum-copper-manganese-magnesium alloy (17S) with small additions of other metals to improve the machining characteristics. This new alloy, known as "R 317," was developed primarily for machining stock, and is available at the present time only in rod and bar form.

Tests have shown that this alloy can be forged and that its use offers advantages where forged parts with free machining qualities are desired. Its physical properties are closely similar to those of the standard 17S alloy. 212

Three Cutting-Oil Bases with Wide Field of Application

Three cutting-oil bases for use in metal-working have recently been added to the line of the National Oil Products Co., Harrison, N. J. The first of these is Nopco 1009-C, which, in addition to a high sulphur and chlorine content, has a specially prepared fatty oil base. It is recommended for steel, brass, and copper cutting operations in which frictional loads are extremely high. It is odorless and free from tarry matter, and blends in all proportions with any diluent petroleum oil down to the required viscosity, sulphur, and chlorine specifications. Blends of this base are non-rusting and non-corrosive on ferrous metals.

The second is a sulphurized cutting-oil base known as Nopco 1009-A, and contains 15 per cent sulphur in both chemical combination and active form. It is recommended for straight cutting operations on ferrous metals, and is used commercially after dilution or blending with low-viscosity mineral oil, in which this base is completely soluble. Such blends may contain anywhere from 1 to 10 per cent of sulphur, depending upon the type of cutting to be done.

The third, known as Nopco 2009-A, is used as a blend with mineral oil for operations requiring rapid removal of frictional heat developed under high loads in cutting operations. It is also employed for grinding, broaching, polishing, and similar metal-working operations where strong detergent properties are required in order to remove rapidly metallic dust or particles from the grinding wheel. This base is soluble in all proportions in mineral oil. 213

To obtain additional information on materials described on this page, see lower part of page 234.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Cincinnati Improved Milling Machines

A medium-sized knee-and-column type milling machine in which many new features and improvements have been incorporated has been brought out by the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. This new 2MI machine is built in plain, universal, and vertical styles. These milling machines have exceptionally wide speed and feed ratios—60 to 1 and 120 to 1, respectively—designed to cover the requirements for all types of milling operations in the metal-working industries. The rapidity and ease with which milling speeds and feeds can be changed is an important advantage developed especially to meet the requirements of modern tool-rooms.

Sixteen speeds ranging from 25 to 1500 R.P.M. are available through the operation of a single crank control which actuates a hydraulic selector valve. A safety interlock prevents the speed-change crank from being moved while the spindle is rotating. A mechanical spindle reverse permits quick and easy reversal of spindle rotation to suit the hand of the cutter without affecting the direction of the feed.

Feed rates are changed in the same manner as the speeds, the complete range of sixteen feeds being from 1/4 inch to 30 inches per minute. Feed controls are independent of each other. Cross and vertical hand-cranks are automatically disengaged when their respective power feed-levers are engaged. This arrangement constitutes an important safety feature for the operator, as it prevents the hand control from spinning during the feed or rapid traverse movements.

The large micrometer dials for the manual adjustment controls are reset by simply pulling them out against a light spring pressure and rotating them to the desired setting. "Live" rapid longitudinal and cross traverse at the rate of 150 inches per minute and vertical traverse at 75 inches per minute are obtained through a lever control at the side of the knee.

The spindle of the horizontal machines runs on three precision bearings, tapered roller bearings being used at the front and center positions and a ball bearing at the rear position. Extra metal on the bull gear serves to produce a flywheel effect which is especially desirable when using sintered carbide cutters, single tool cutters, or end-mills having widely spaced teeth. The spindle nose conforms to the No. 50 Milling Machine Manufacturers' Standard.

The working surface of the table of both plain and universal machines is 49 by 10 inches. The table has a longitudinal movement of 28 inches and a cross movement of 10 inches. The vertical movement of the table for the plain machine is 19 inches, and for the universal machine 18 inches.

The design is such that the motor and its mounting can be removed as one unit by unscrewing four bolts. This construction also serves as a convenient means for adjusting the tension of the V-belt drive.

The main drive clutch is a single-disk dry-plate unit which is easily accessible for adjustment. A mul-

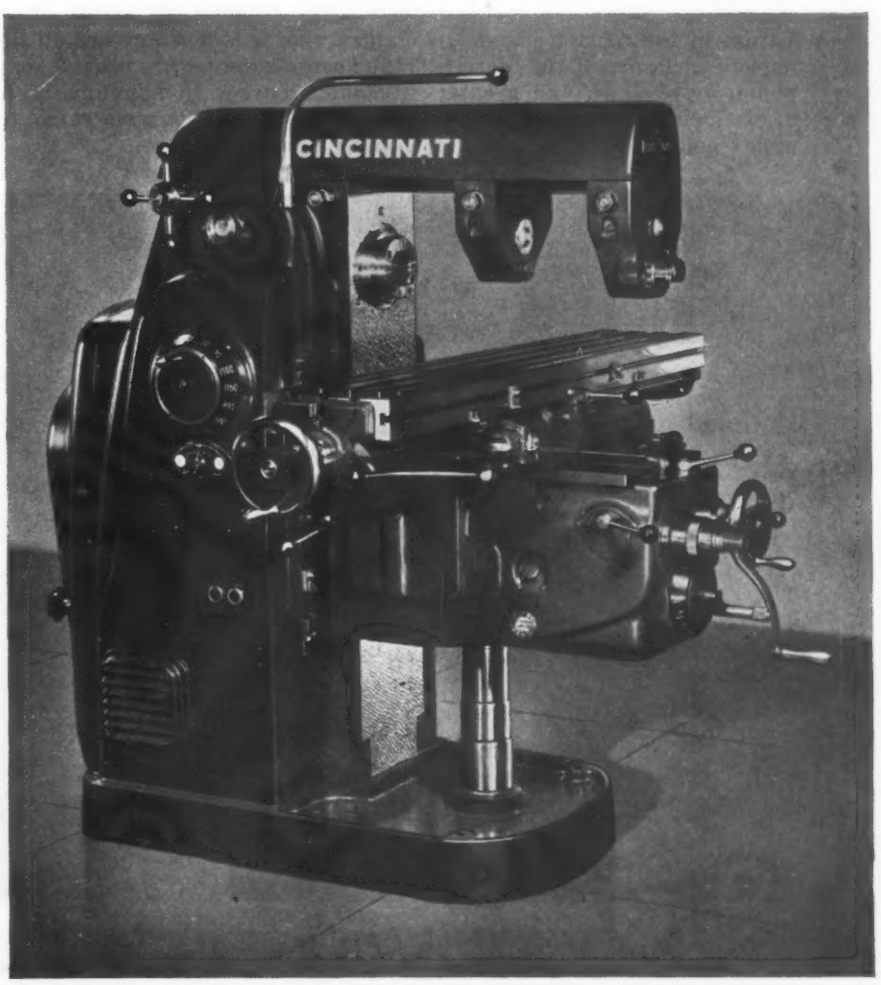


Fig. 1. Plain Milling Machine of Improved Design Brought out by the Cincinnati Milling Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

tiple-disk spring-loaded brake operated by the disengaging action of the starting lever stops the spindle instantly when the drive clutch is disengaged.

Parts within the column and knee are automatically lubricated from individual pump and cascade systems, with tubing carrying oil to out-of-the-way bearings. The pump in the column also supplies oil under pressure to the hydraulic gear-shifting mechanism. The vertical feed-screw runs in an oil bath. Table ways and parts within the saddle and housing are lubricated by a manual pressure or "oil shot" system built into the saddle. Arbor support bearings are automatically lubricated by a gravity system from self-contained, dust-tight reservoirs which have their own individual glass sight level gages.

The over-arms fitted in dovetail ways at the top of the column incorporate a built-in vibration dampener. The arbor support brace supplied with these machines can be reversed to present the vertical section to either the right or left of the knee. Electrical controls are built in for protection against dust and coolant, and have various safety features designed for the protection of machine and operator.

A feature of the coolant system is the complete enclosure of the centrifugal pump, drive-shaft, and greater portion of the coolant supply piping. The pump and its drive-shaft are accessible for servicing by removing a long narrow cover.

The main drive clutch, brake, and all spindle drive gearing up to the back-gear shaft are contained in a unit bolted to the rear wall of the column. Feed drive gears are also contained in a unit bolted to the under side of the knee. This type of construction serves to facilitate maintenance.

The vertical style machine, shown in Fig. 3, has essentially the same controls and construction as the horizontal machines, with the exception of the back-gear shift lever on the left-hand side. The back-gear construction is designed to maintain consistently low and more desirable speeds throughout the spindle drive. The vertical head has its own lubricating system, which employs two plunger pumps operated by an eccentric collar on the vertical spline shaft. The vertical machines are equipped with power feed and power rapid traverse to the head and a four-position turret stop. When the power feed or rapid traverse is engaged, the handwheel is automatically disengaged. Feed rates to the head range from 1/8 inch to 15 inches per minute, while the rapid traverse rate is 75 inches per minute. The turret stop serves as a quick and convenient adjustment of the head when milling production work having finished surfaces at different heights. The head can be quickly and securely clamped by a lever.

Many attachments are available, particularly for the horizontal machines. These include circular milling tables, several types of vertical and universal spindle attachments, motorized over-arm, and manual controls at the rear operating position. 81

Diamond Milling Machine

A new M-30 miller designed to meet the requirements for a low-cost machine capable of performing heavy milling operations has been brought out by the Diamond Machine Tool Co., 3429 E. Olympic Blvd., Los Angeles 23, Calif. It is claimed that this machine has all the refinements necessary to provide long life and accuracy in handling high-production work on a wide range of milling applications.

The table of this machine is 7 by 30 inches, and has a longitudinal travel of 18 inches, a transverse travel of 6 inches, and a vertical travel of 10 inches. An automatic screw type table feed can be furnished for tool-room use, or the machine can be obtained with a rack and pinion table feed for high-production work.

The spindle is mounted in Timken roller bearings, and its hardened and

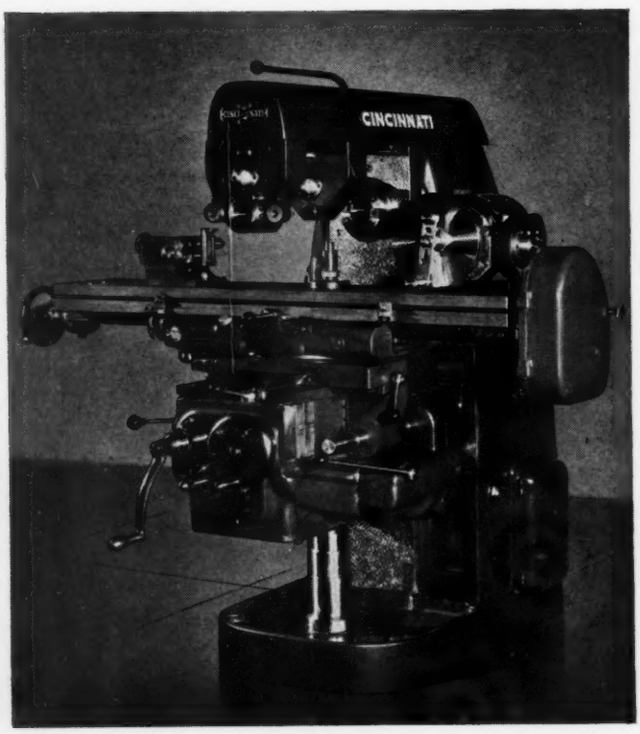


Fig. 2. Cincinnati Universal Milling Machine of Improved Design

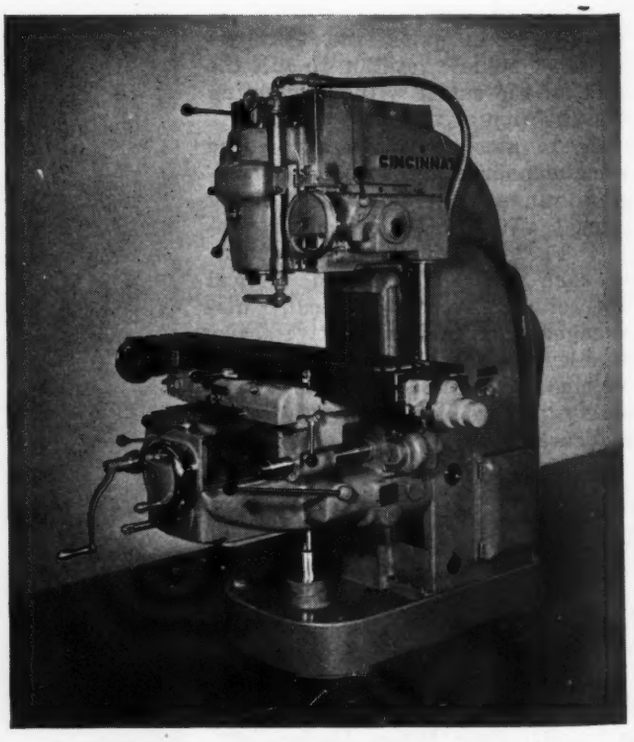
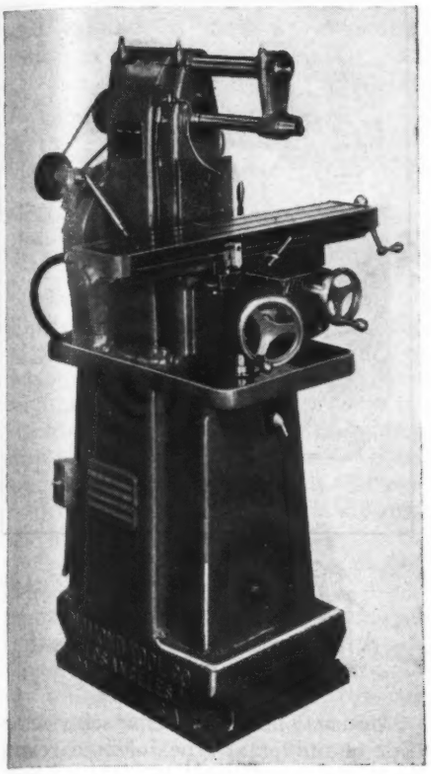


Fig. 3. Cincinnati Vertical Milling Machine with New Design Features

To obtain additional information on equipment described on this page, see lower part of page 234.



M-30 Milling Machine Built by Diamond Machine Tool Co.

ground nose has a No. 9 B & S taper. Regular equipment includes a variable-speed drive, built-in gusher pump, coolant system, and a 1 1/2-H.P. motor. 82

Airco Extrusion-Coated Self-Hardening Electrode

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., has announced a new extrusion-coated self-hardening electrode, manufactured by the Stoody Co., which is now available through Airco dealers. This electrode is said to have excellent arc characteristics, working equally well with either an alternating or a direct current. The extruded coating is much stronger, has less tendency to pick up moisture, presents a better appearance, and is completely uniform. It is adapted for hard-facing operations such as are required in building up worn areas of tractor lugs, shovel teeth, manganese steel crushing equipment, pump casings, clutches, spindles, coupling boxes, bulldozer blades, and similar equipment.

Other advantages claimed for this electrode include no slag interference; more rapid deposition rate; applicable in all positions; no loss of hardness or wear resistance on multiple layers; solid dense deposits with minimum porosity; satisfactory application within a wide range of amperages; easy slag removal while deposit is still red-hot, the slag being self-lifting when the deposit cools; and applied by any desired type of bead, including stringers, figure eight's, weaving beads, etc. 83

Universal "Boardmaster" Drafting Machine

The Universal Drafting Machine Co., Cleveland 14, Ohio, has just announced a new model drafting machine known as the universal "Boardmaster." This completely redesigned drafting machine embodies improvements developed during the war years which give it many outstanding advantages over previous models. Greater versatility, more rugged construction, a higher degree of precision, and easier operation are advantages claimed for the new machine.

The centralized control of this drafting machine places every operating control at the finger tips of the draftsman's left hand. These controls, all arranged for easy operation within a 2-inch radius, permit the "Boardmaster" to be operated virtually by feel alone, without requiring the eyes to be taken from the drawing. A push-button located in a natural operating position under the left thumb provides automatic indexing of the scales every 15 degrees.

The precision-cut dial with large, easily read numerals has complete 360-degree visibility of both dial and vernier readings at all times. An ingeniously designed double-wing lever operated by the left thumb facilitates locking the instrument at any intermediate angle. Accurate setting of the scales to any desired base line and rapid drawing alignment are obtained by a toggle clamp operated by the index finger of the left hand.

An outstanding feature of the "Boardmaster" is the fact that it is adaptable to all kinds of drawing tables, located in either horizontal, sloping, or vertical positions. By the simple and rapid assembly of "packaged accessory units," the "Boardmaster" can be converted from a horizontal machine to a vertical machine. The board tilting range of a basic unit is from 0 to 3 degrees; by adding a cartridge stabilizer to the upper arm, the range can be increased to from 0 to 7 degrees; by adding a stabilizer to the lower arm as well, from 0 to 20 degrees; by the use of a weight type counterpoising unit, from 0 to 90 degrees. Counterbalancing at any angle with this equipment is frictionless and without drag.

Other new features of this drafting machine include synthetic sap-

"Boardmaster" Drafting Machine of Improved Design, Built by Universal Drafting Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

phire supporting feet or "glides," designed to slide easily over the new highly abrasive drawing papers without smudge or wear; greatly increased ruggedness in the heavier arm and protractor cross-sections; a built-in key wrench anchor clamp and hinged anchor; easily replaceable snap-lock enclosed steel bands; diamond turned pulleys; spot color controls; and glareless aluminum matte finish. 84

Profile Grinding Machine

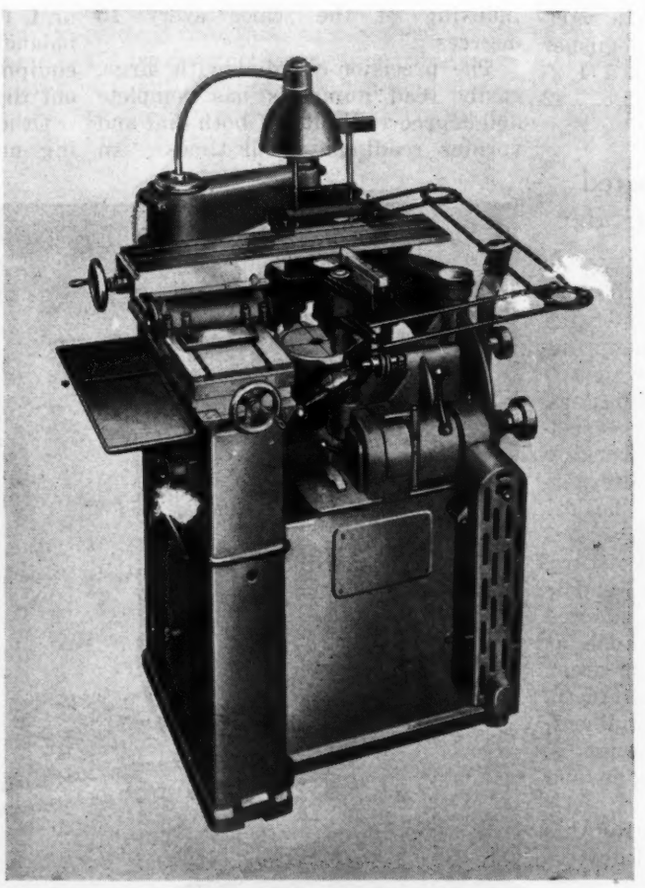
The Cosa Corporation, 5000-4 Chrysler Bldg., New York 17, N. Y., is introducing in this country a Type PSM high-precision profile grinding machine. This machine is manufactured by Fritz Studer Ltd., Clockenthal-Thun, Switzerland. It has been especially constructed for grinding the profiles of hardened work, such as profile gages, form tools, sectional dies, etc., used in the machine and watch manufacturing industries. Flat work up to 2 inches thick and 5.9 inches long, and circular pieces up to 4 inches in diameter can be ground on this machine to an accuracy of plus or minus 0.0002 inch.

The principle of operation consists of following, by means of a tracer finger, the form or outline of a templet which has been enlarged to suitable proportions. Linear movements are transmitted to the grinding wheel head through the pantograph and swiveling movements by turning the wheel about its cutting edge through the use of link bars. The wheel must be shaped proportionately to correspond to the exact shape of the tracer finger point.

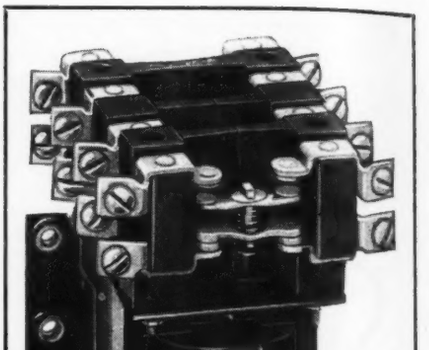
The pantograph can be adjusted to give any ratio required. The accurate forming of the wheel to the shape of the tracer finger point is effected by moving the latter along the edge of a hinged guide bar on the templet table, which can be turned or folded down for the purpose. In holding the tracer finger at all angles during this operation, the movements are reproduced by having the wheel come in contact with the diamond, which is brought exactly in line with the extended swivel axis of the wheel-head by means of a dial indicator. The diamond-holder and workpiece are both fixed on a revolving table mounted on the vertical slide, and each can, in turn, be placed opposite the grinding wheel. The stroke of the vertical slide is from 0 to 2.44 inches. For grinding clearance angles on a form tool, the tool is fixed on an inclinable workrest, which is tilted to the required angle, and the templet table is inclined to the same angle.

This machine is also particularly well suited for grinding dies of the type used in the watchmaking industry. Such dies may be divided into several sections, the most suitable places being chosen for the dividing lines, so that each section can be ground separately.

A special attachment is available for grinding profiles up to 360 degrees on circular work, such as disk cams and parts for clock mechanisms. A dust exhauster and balancing device for grinding wheels can be supplied as additional accessories. 85



PSM Profile Grinding Machine Placed on the Market by the Cosa Corporation



Allen-Bradley Solenoid Relay

Allen-Bradley Universal Solenoid Relay

Unusual flexibility characterizes a line of universal type solenoid relays recently developed by the Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In these relays, which are a recent addition to this company's regular Bulletin 700 line of solenoid relays, a simple shift of connections makes it possible to change a set of normally open contacts to normally closed operation or vice versa. Thus the equipment designer can provide for future changes with a minimum number of components.

The Bulletin 700 universal solenoid relays are available in two-, four-, six-, and eight-pole construction. All the contacts on the two- and four-pole relays are of the universal type. The six- and eight-pole relays have only four sets of universal contacts, the remaining contacts being of the conventional normally open or normally closed type which can be changed in the field. These relays have a maximum current rating of 10 amperes, and can be obtained for operation on 25, 30, 40, 50, and 60 cycles and 6, 12, 24, 32, 64, 110, 220, 440, 550, and 600 volts. The universal type should only be used for switching circuits of like polarity,

To obtain additional information on equipment described on this page, see lower part of page 234.

and cannot be used as reversing switches.

These relays can be obtained either in the open style or mounted in an enclosure. Three enclosures are available — the standard general-purpose NEMA Type 1 sheet-steel enclosure; the water-tight and weatherproof NEMA Type 4 cadmium-plated cast-iron enclosure; and the cast-iron NEMA Type 7 enclosure for use in hazardous gas locations. 86

Pond Automatically Controlled Turntable Tapping Fixture

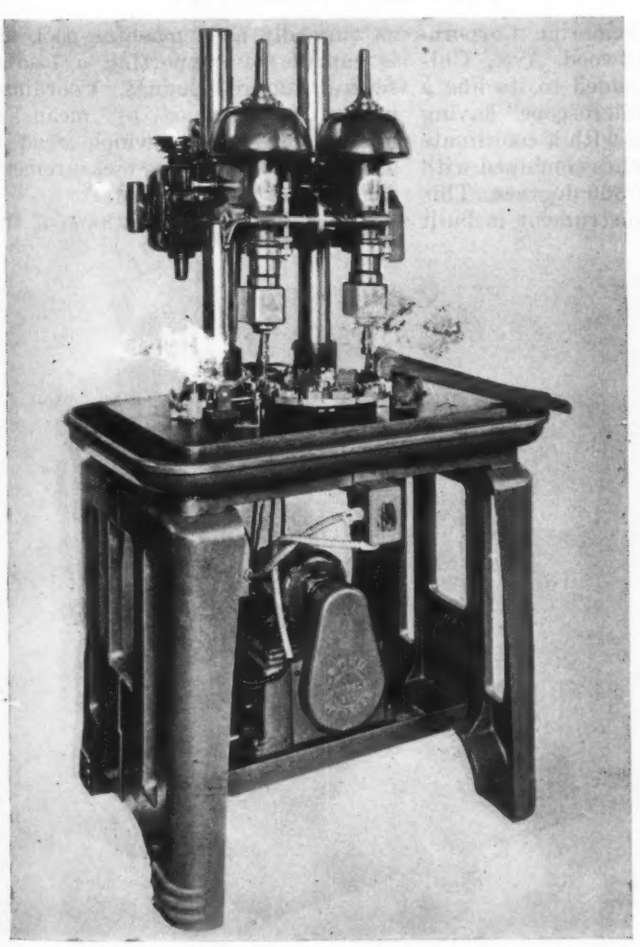
The Pond Engineering Co., 15 Park St., Springfield, Mass., has designed an automatic control unit for adapting hand-operated tapping units to automatic operation. Accurate indexing, locating, clamping, tapping, and ejecting of the work are all accomplished on a turntable fixture, which is actuated by the Model 600 "Pond Operator."

The machine illustrated is equipped for handling two different pieces simultaneously. One hole is tapped in each piece and the pieces are ejected into a chute which is divided in the middle to separate the two different parts. Work that cannot be adapted to hopper or magazine handling is fed to the machine by an attendant. Different pieces of a similar design can be handled on the same machine by simply changing the holding blocks on the turntable. The machine can be adapted for performing combinations of several operations, such as drilling, tapping, reaming, riveting, grinding, burring, and countersinking.

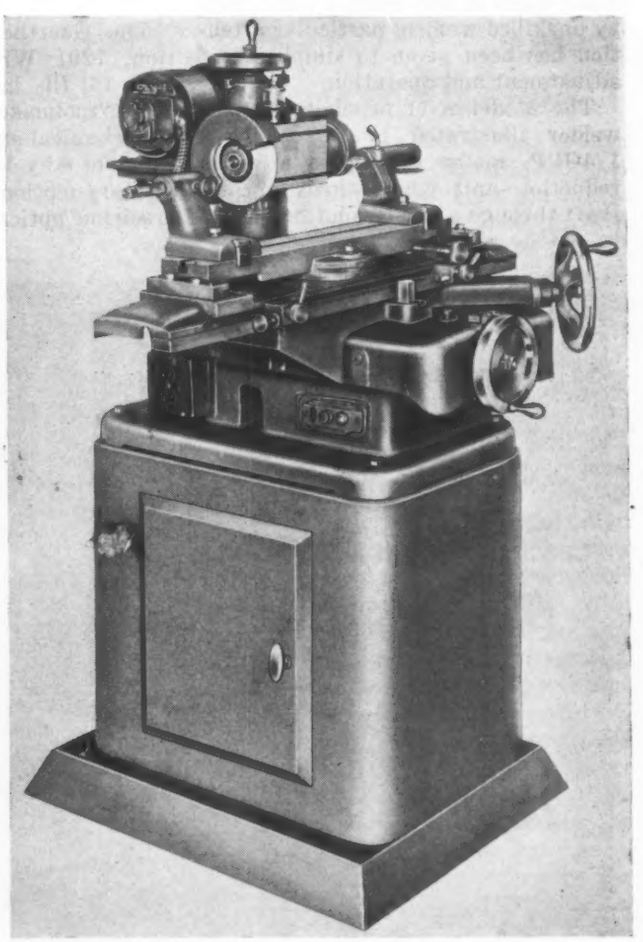
The "Pond Operator" is primarily a control unit with a one-cycle, air-clutch operated camshaft, driven by a 1/3-H.P. motor. A minimum of 70 pounds per square inch air pressure is required to operate the device. Standard equipment includes four air valves, but additional valves and mechanical cams can be supplied. Cycle speeds are adjustable from two seconds to one minute, depending upon the operation performed, but provision for longer cycles can be made. The frequency and duration of the impulses per cycle can be adjusted by controls on the air-valve cams. 87

Excel Universal Cutter and Tool Grinder

A No. 6 universal cutter and tool grinder designed to sharpen reamers and milling cutters of a wide variety of shapes and in sizes up to 8 inches in diameter by 16 inches long has just been announced by the Covel Mfg. Co., Benton Harbor, Mich. This machine is also adapted for cylindrical and internal grinding operations. It can be equipped with a universal face-mill grinding attachment which swivels 360 degrees vertically or horizontally, and with a 1/30-H.P., 1150- or 1425-R.P.M. motor for revolving a live-center headstock spindle. Other special attachments available include spindle extensions; internal grinding unit; 4-inch, 3-jaw universal chuck with inside and outside jaws, or a 4-jaw



Turntable Tapping Fixture Equipped with Pond Automatic Control



Universal Cutter and Tool Grinder Made by the Covel Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

independent type chuck; and tilting swivel vise.

The spindle of this machine is 1 1/2 inches in diameter, and is mounted in spring-loaded precision ball bearings, arranged to automatically take up end play and eliminate wear. One end of the spindle is tapered to receive grinding wheel collets for mounting wheels up to 6 inches in diameter with 1/2-inch face and 1 1/4-inch arbor hole, while the other end has a straight arbor 1/2 inch in diameter for mounting small-diameter cup-wheels. The spindle has a vertical movement of 7 inches, and is driven by a 1/3-H.P., 1750- (60-cycle) or a 1425- (50- and 25-cycle) R.P.M. motor.

The table measures 4 by 24 inches, and has a longitudinal travel of 14 inches. An exceptionally smooth and free movement of the table is provided by the firm meshing action of the hardened spiral teeth of the rack-and-pinion mechanism. The top surface of the table is 41 inches from the floor. The maximum vertical distance from the center of the spindle to the top of table is 9 3/4 inches, and the minimum distance 2 3/4 inches. 88

Thomson Motor-Driven Spot-Welder

A bench type motor-driven spot-welder has recently been developed by the Thomson Electric Welder Co., Lynn, Mass., to provide a compact, accurate machine suitable for the rapid resistance welding of small parts. Welders of this type are generally used for assembling small parts which are handled quite rapidly, so that compactness is desirable, in order to provide as much bench space as possible on each side of the welder. Since much of this work is performed by unskilled women, particular attention has been given to simplicity of adjustment and operation.

The Model A-11 bench type spot-welder illustrated is driven by a 1/4-H.P. motor geared to a worm reduction unit which turns a camshaft through a one-revolution clutch. Operation is initiated through a solenoid clutch-pulling mechanism controlled by a foot-actuated push-button. With this arrangement, the operator can either trip the clutch once to put the machine through a single welding cycle or he can, by steady pressure on the switch, keep the machine running continuously.

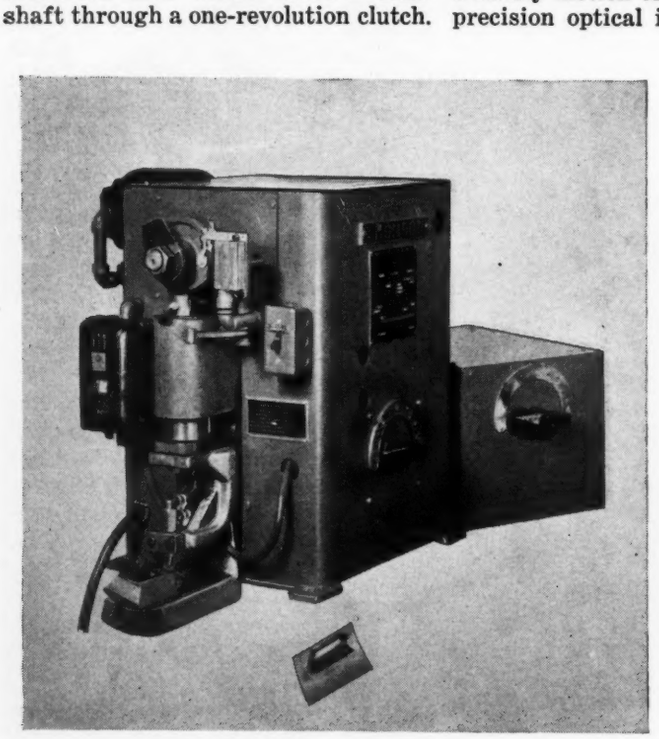
Two transformer capacities — 10 and 15 KVA—are available. Current control is obtained by a multi-leaf fan type cam mounted on the camshaft. This cam controls a limit switch which operates the magnetic contactor or other timing device. Extending or shortening of the arc formed by the fan cam determines the duration of current dwell. Heat is controlled by a five-point regulator with a heavy copper arm and contacts designed for maximum loads.

The method of applying the pressure is almost an exact duplicate of the system employed on most heavy welding presses. A round cast-bronze spindle which slides in a cast-iron ram provides a vertical motion for the upper arm. The pressure cam is designed to cushion the electrode travel and to avoid hammering. A two-way adjustment of the lower arm, which can be raised or lowered or shifted laterally as the nature of the work requires, is also provided. The electrodes are water-cooled, and all models have a visible cooling water drain. 89

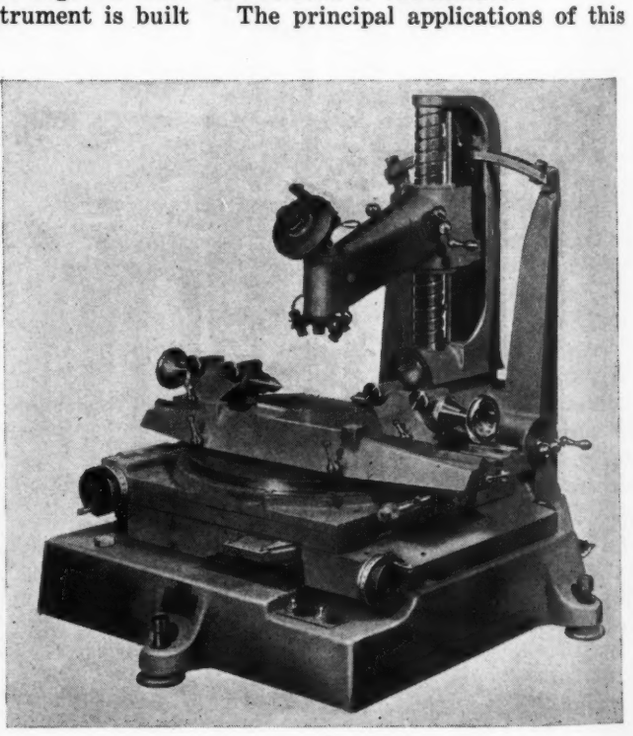
Gaertner "Toolmaker Microscope"

The Gaertner Scientific Corporation, 1201 Wrightwood Ave., Chicago 14, Ill., has added to its line a large "toolmaker microscope" having a mechanical stage with a coordinate range of 8 by 4 inches combined with a rotary motion of 360 degrees. This precision optical instrument is built as ruggedly as a machine tool, and is capable of supporting a load of several hundred pounds. Coordinate motion is obtained by means of micrometer screws which read to 0.0001 inch. Angular measurements can be read to one minute.

The principal applications of this



Motor-driven Bench Type Spot-welder Built by Thomson Electric Welder Co.

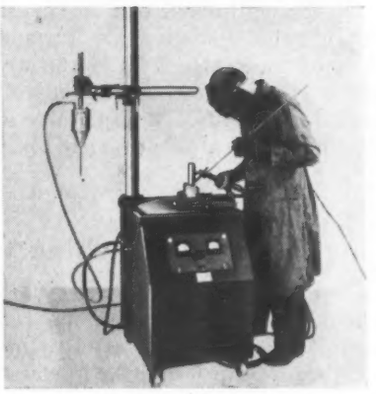


"Toolmaker Microscope" Developed by the Gaertner Scientific Corporation

To obtain additional information on equipment described on this page, see lower part of page 234.

instrument include inspection and measurement of large tools, jigs, templets, machine parts, threads, and similar items that must be held to very close tolerances. The instrument consists primarily of the mechanical stage; a 30-power microscope mounted on a supporting column which has micrometer-controlled tilt up to 15 degrees each side of the vertical position; a removable cradle for supporting objects not readily mounted on the flat surface; and sub-stage illuminators.

The microscope is equipped with an internal protractor for rapid angular measurements to 1/2 degree, and a protractor ocular head by means of which angles can be read to one minute. The protractor ocular head is easily removed to permit the use of the templet ocular head which accommodates thread and radius templet slides, all of which are available as accessories. Both rapid and fine focussing adjustments are provided. The magnifying power can be varied from 10 to 100 by means of interchangeable objectives. A camera attachment is also available. 90



Thomas "Metal Master"

Thomas "Metal Master"

The Clinton Machine Co., Clinton, Mich., is manufacturing a machine designed to perform eight different types of metal-working operations. This machine, known as the "Thomas 8-in-1 Metal Master," can be used for metal disintegration, arc-welding, brazing, soldering, drill pulling, air extraction, metal etching, and demagnetizing operations in tool- and die-rooms, tool salvage and maintenance departments, and on production lines. Mounted on steel casters, it can be easily rolled to any part of a plant. By simply connecting the power lead to a convenient electric current outlet, any of the units can be put into operation.

A new process of metal disintegration employing a low-voltage, high-ampere current flow to create a high-temperature arc at the point of contact makes it possible for this machine to accurately cut high-speed steel, tool steel, stainless steel, cemented carbides, Stellite, beryllium, vanadium alloys, or any of the other hard metals developed during the war. It is claimed that this work can be accomplished rapidly and without annealing or affecting the hardness of the metal or overheating and distorting the work-piece.

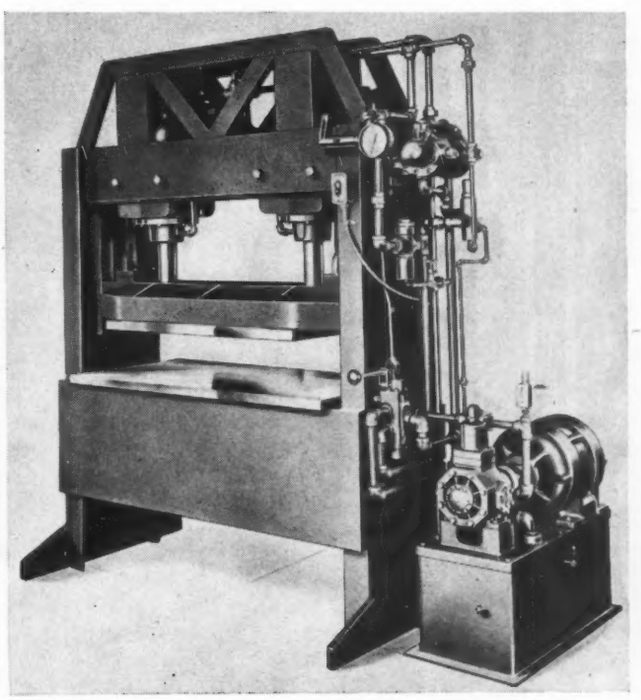
It can be employed to quickly disintegrate embedded broken high-speed tools or studs and screws from work-pieces without damage to metal or threads; correct production errors by drilling holes and cutting slots and channels in the hardest metals after heat-treatment; cut keyways in hardened shafts and gears; pierce hardened armor plate; and drill holes in hardened dies.

The arc-welding unit can be used for flat, vertical, overhead, or horizontal welding. It provides a 100-ampere current for thirty-minute runs and up to 200 amperes for intermittent runs, with eight heat stages.

The drill-puller unit is designed to remove straight, broken objects such as drills, reamers, pins, and plug gages from work-pieces or machinery. Still another extractor unit using air as a coolant instead of liquid provides a means for quickly removing broken pieces from hard-to-get-at places where the regular Thomas disintegrator head cannot be employed. This unit can be operated at a distance of 40 feet from the Metal Master, and can be employed overhead or under machinery for the removal of taps and other objects of any size. The metal etching unit will etch numbers, designs, names or other information on castings and machine parts. 91

Wilson Light-Weight Blanking and Forming Press

An 80-ton blanking and forming press designed with the object of eliminating tons of needless weight and reducing the cost of this type of equipment without sacrifice in operating efficiency has been announced by K. R. Wilson, 215-217 Main St., Buffalo 3, N. Y. The new KRW presses can be built with open or closed ends and with greater or less capacity.



Wilson Blanking and Forming Press of Light-weight, High-strength Construction

The 80-ton press illustrated was designed for blanking, stamping, and forming sheet-metal parts, and for cutting cloth, rubber, asbestos, and similar materials with steel-rule dies. It is also adaptable to compression molding of rubber and plastics. The two heavy-duty hydraulic cylinders of this machine develop the controlled pressure used to perform the press work. Pressure is accurately equalized between the cylinders by means of a mechanical linkage and torque bar arrangement. This linkage assures equal travel of each ram with no thrust load on the rams or packings.

To obtain additional information on equipment described on this page, see lower part of page 234.

Pump equipment can be furnished to suit the customer's requirements. Any of the dimensions of the welded press frames can be changed to suit individual needs. An adjustable automatic stop can be provided to regulate the length of the stroke. The platen of the press can be stopped and reversed at any point in its travel. All parts of the hydraulic system are self-lubricating and are designed for efficient operation.....92

Vertical Machine for Boring Large Cylinders

A hydraulically operated vertical boring machine for precision rough- and finish-boring of large cylinders up to 40 inches in length and 6 to 8 inches in diameter has been designed by the Giern & Anholtt Tool Co., 1318 Mt. Elliott Ave., Detroit 7, Mich. This machine, known as the Model TR, has the spindle piloted directly above the work in a "Gatco" sealed rotary bushing, and is equipped to bore cast iron, steel, or non-ferrous tubes with a multiple-blade boring cutter. It has a feeding rate of 4 inches per minute for roughing and 4 1/2 to 5 inches for finishing operations on the inside diameter of 8-inch tubing.

The power requirement for operating this machine is approximately 10 H.P. Adequate cooling is provided by directing a flow of coolant over the cutter during the entire operation. The work is held in a fixture of the self-equalizing type. 93

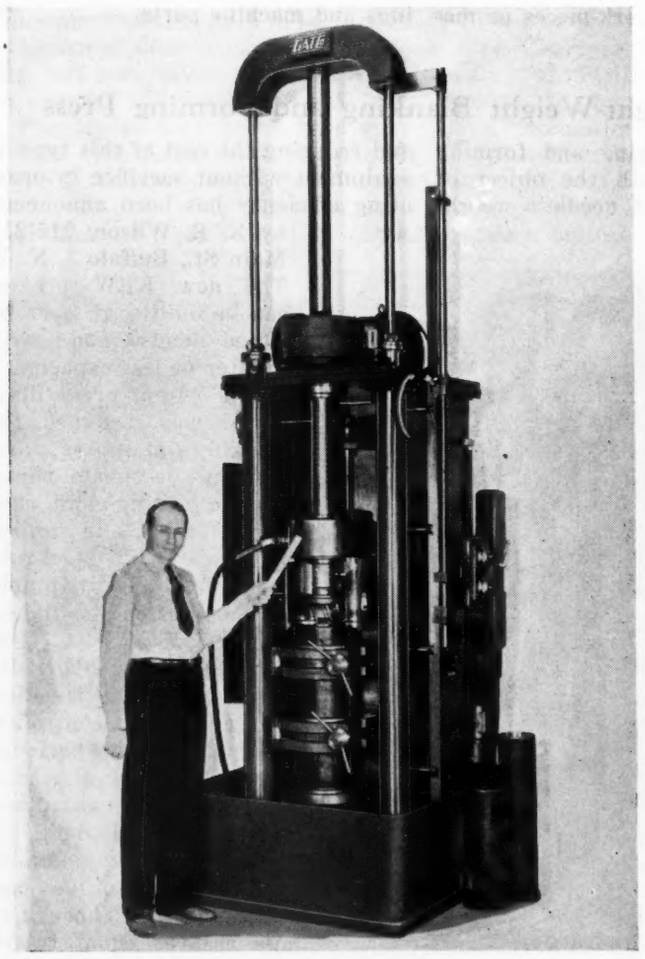
Royal Oak Tool Grinder

A tool grinder developed to make radial-helix relief grinding as simple as the conventional angular back-off relief grinding is a new product of the D-S Grinder Division, Royal Oak Tool & Machine Co., Royal Oak, Mich. This grinder provides means for radial relief sharpening up to the cutting edge with sharp intersections and no under-cuts. It also permits leaving any desired margin on the blade sides. Radial and helical relief can be produced simultaneously, and can be varied to suit requirements.

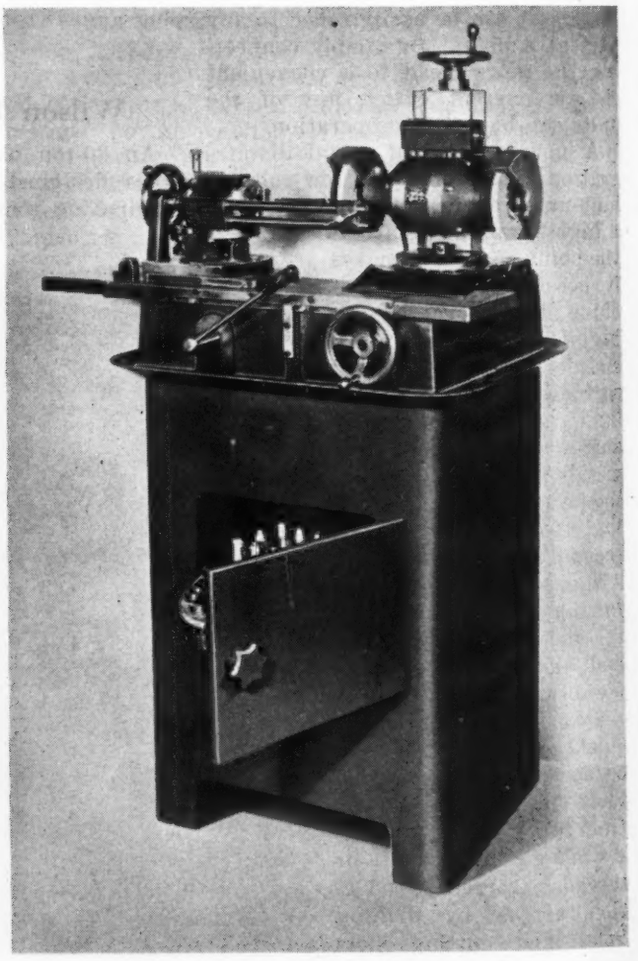
Cam- and index-plates provide for grinding any tool having from one to twelve flutes with identical relief on each blade. The grinder is a universal type machine, and can be employed for relieving end, form, taper, and side cutting tools and for circle grinding and flute grinding, as well as other tool grinding operations. Tools are supported rigidly between centers or in a collet during the grinding operation. 94

G-E Magnetic-Field Gage for Magnetic-Particle Testing

A new magnetic-field gage which indicates the relative strength of the magnetic field in parts that are being examined for flaws by the magnetic-particle method of testing has been brought out by the General Electric Co., Schenectady 5, N. Y. This instrument is especially useful for testing large castings and forgings in which it is difficult to calculate

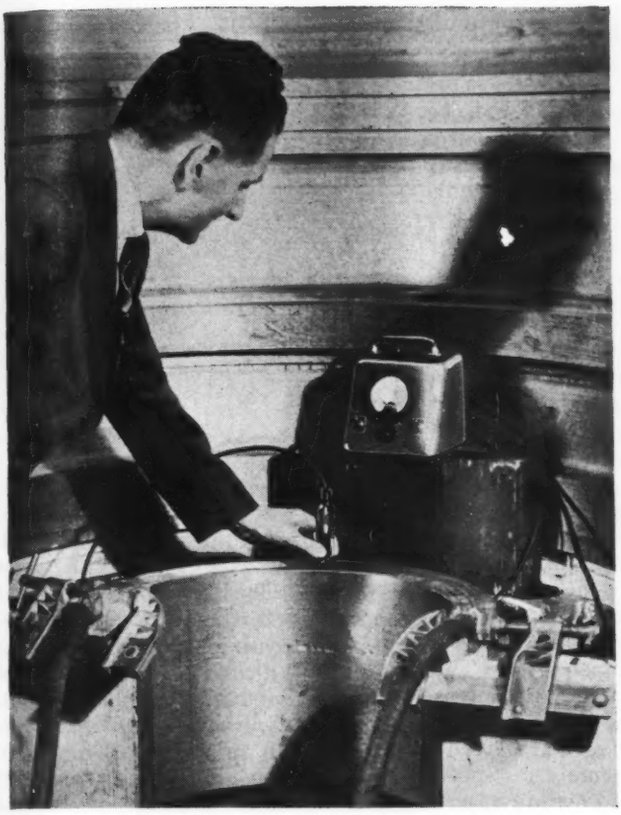


Vertical Cylinder-boring Machine Made by Giern & Anholtt Tool Co.

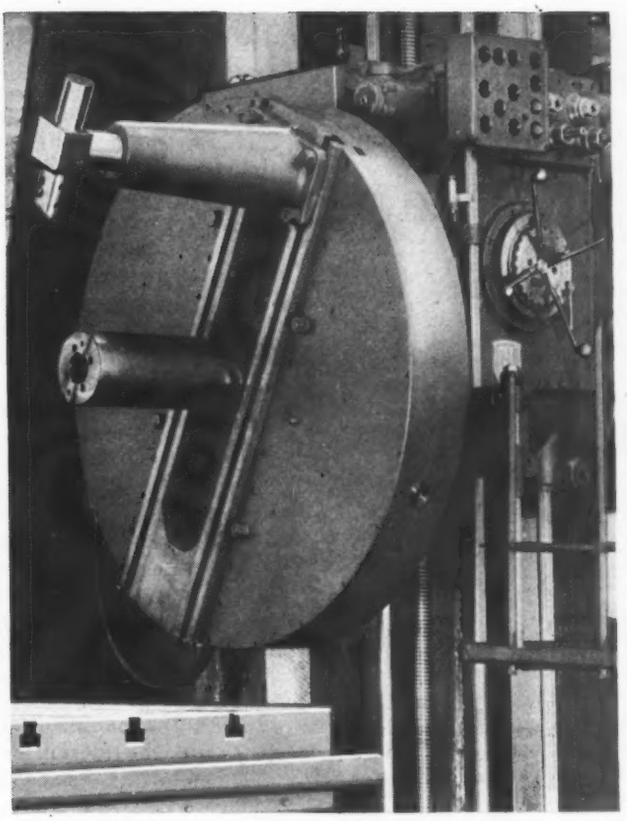


Tool Grinder Built by D-S Grinder Division, Royal Oak Tool & Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 234.



Magnetic-field Gage Developed by General Electric Co.



Giddings & Lewis 60-inch Continuous-feed Facing Head

the field intensity at various points from the current passed through the part and the cross-sectional areas.

In testing parts for flaws by the magnetic-particle method, a magnetic field is first set up in the part. Then magnetic particles are distributed over the surface of the part, which line up along any crack or flaw. This new equipment assures a magnetic field that is sufficiently strong to bring out the particle pattern, so that defects of the same size give similar indications. By giving a direct indication of field strength, it is possible to standardize the test at fixed field intensities. The instrument measures both alternating- and direct-current field strength. Small and portable, it can be used wherever 115-volt 60-cycle power is available.

In operation, the pole shoes of the instrument are placed in contact with the test surface. Direct or alternating current is then applied to the part in accordance with the regular magnetic-particle method. The current is increased or decreased until the magnetic-field gage indicates the desired field units for the particular test, after which the magnetic particles are applied. 95

Giddings & Lewis Boring and Facing Attachment

A variety of boring, turning, grooving, recessing, and threading operations that are difficult to perform on ordinary equipment can be easily handled on the continuous-feed facing and boring heads now being manufactured by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. A 60-inch diameter continuous-feed facing head with a telescopic tool-holder mounted on the tool-slide is shown in the accompanying illustration. In this installation, the machine spindle extends through the head.

This attachment can be mounted on the spindle sleeve of the Giddings & Lewis horizontal boring machine headstock or, with a suitable adapter, it can be used on a line boring-bar. When the unit is placed on the headstock, the machine spindle, extending though the attachment head, operates either independently or simultaneously with the head. This arrangement permits combining machining operations, and thus makes possible a substantial saving in production time. When used with an adapter and mounted on a line boring-bar, the machining of surfaces that are difficult to reach with ordinary tools is greatly simplified. The attachment is particularly well adapted for machining large and cumbersome work which cannot be easily relocated.

Typical applications of this attachment include large open and blind hole boring beyond the range of standard boring tools; trunnion, stud, or similar turning operations; internal machining of forging dies; machining both sides of a work-piece simultaneously, using two continuous-feed facing heads, one mounted on a boring-bar and the other on the machine spindle sleeve; internal and external grinding operations using a special grinder mounted on the tool-slide.

Continuous-feed facing heads are available in a number of sizes, from 17 to 60 inches in diameter. Cross-travel of the tool-slide ranges from 10 inches on a 22-inch diameter head to 34 inches on a 60-inch head. The maximum facing diameter is 32 inches, using a 22-inch continuous-feed facing head, and 96 inches using a 60-inch facing and boring head. Six separate power feeds arranged in geometrical progression are available through a manually operated selector. The tool-slide can be fed in either direction. A precision feed-worm with a micrometer dial registers the amount of feed. This dial is graduated in increments representing 0.001 inch travel of the tool-slide. 96

To obtain additional information on equipment described on this page, see lower part of page 234.

Weaver Multiple-Spindle Turret and Variable-Speed Unit for Drill Presses

Two new attachments—a multiple-spindle turret (Fig. 1) and a variable-speed unit (Fig. 2) for drill presses of 17-inch minimum capacity—have been placed on the market by the Weaver Aircraft Corporation, San Diego, Calif. The Weaver "Multi-6-Spindle" turret attachment has six vertical spindles. This unit can be rigidly attached to the drill press column by a simple cast-iron bracket so that it becomes practically an integral part of the drill press, which is not changed in any way. The quill of each spindle is mounted on two preloaded precision ball bearings, and the driving mechanism is attached directly to the quill of the drill press.

Fig. 1. Multiple-spindle Turret Attachment for Drill Presses

All operations that can be performed on the drill press can be handled on the multi-spindle turret, including light boring and lead-screw tapping. As many as six different operations can be performed on the same working center without changing the set-up. All tools that can be used in the drill press chuck can also be employed in any or all of the six spindles. The working stroke is approximately 4 inches. Tools with shanks up to 1/2 inch in diameter can be used. The lead-screw mechanism can be installed in any of the six spindle positions or, if desired, all six spindles can be equipped for drilling. Any standard tapping attachment can be used on the spindles of the turret.

The indexing mechanism can be operated manually or semi-automatically with air-actuated release. The operating depth of each spindle can be preset by positioning the stop-ring and stop-screw. Coolant for the cutting tool is fed down through the center of the unit, and is directed to the working point without interference from tools or fixtures. Lubrication is effected by simply applying a few drops of oil on the spindles and the center mounting tube, the main bearings being of the presealed type.

The "Vari-Speed" unit is designed primarily for V-belt driven drill presses. Two telescoping disks are employed to increase or decrease the speed ratios between the drill press motor and the drive, as the single hand-lever control is advanced or retarded along the control track. The unit is attached at the drill-press motor mounting base after relocating the motor on the "Vari-Speed" mounting plate assembly. Speed variations are obtained during operation of the drill press, and can be gradual or stepped up or down in fixed intervals as required. 97

Hydro-Aire Multi-Way Selector Valves

Hydro-Aire, Inc., 626 N. Robertson Blvd., Los Angeles 46, Calif., is manufacturing a complete series of industrial two-way, three-way, and four-way selector valves which are capable of handling up to 2500 gallons per hour with a negligible pressure drop. The sizes of these valves range from 3/8 inch to 1 1/2 inches. Patented sealing methods, such as those used in critical aircraft fuel valves, are employed in these valves.

Multi-way Selector Valve Made by Hydro-Aire, Inc.

The new valves are said to be extremely light in weight. They have a low operating torque; are not affected by back pressures; are suitable for use at temperatures ranging from minus 65 degrees F. to plus 200 degrees F.; are small in size for the large capacity of fuel handled; can be used for any type of liquid; and can be serviced by inexperienced personnel. The valve can be set for 200 pounds per square inch, and will withstand operating pressures of 1000 pounds per square inch. A similar unit can also be supplied in small sizes for use in compressed-air lines. 98

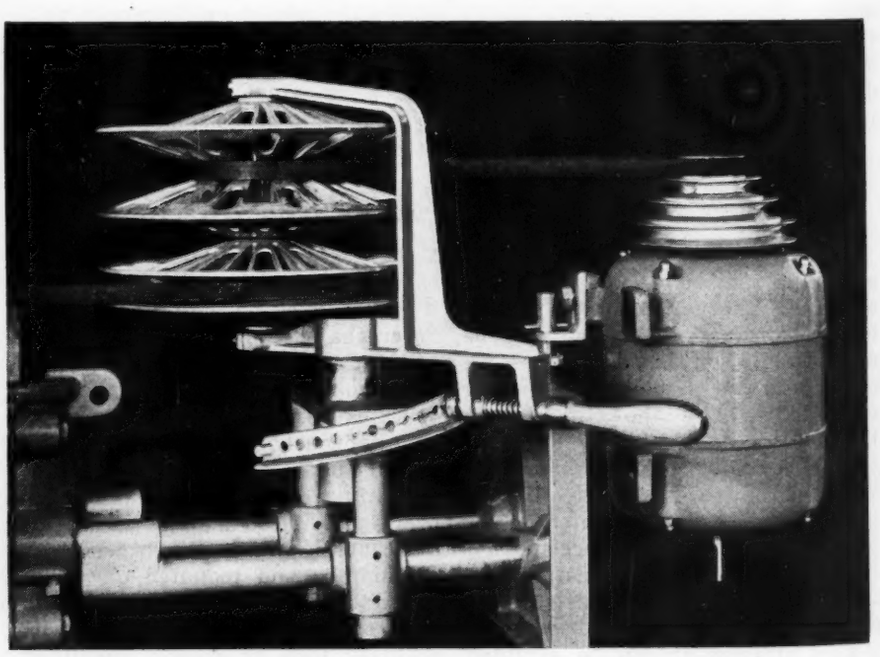


Fig. 2. Variable-speed Attachment for Drill Presses

To obtain additional information on equipment described on this page, see lower part of page 234.

Superdraulic Small-Size, High-Power Hydraulic Motor

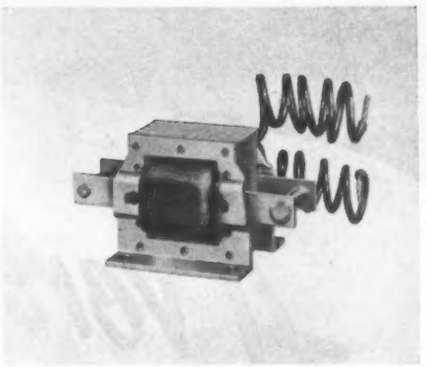
A new type of industrial hydraulic motor combining high starting torque with turbine-smooth power is a recent development of the Superdraulic Corporation, Dearborn, Mich. This motor, known as the "Superdraulic Triport," parallels the Superdraulic line of high-pressure hydraulic pumps described in April MACHINERY, page 228. It makes available a perfectly balanced combination of pumps and motors, each designed to insure efficient operation when combined with a complete power transmission system.

The compactness of the new midget-size 47-H.P. Superdraulic motor makes direct drive available for machines that could not previously employ this type of power application. In the case of high-power milling machines, for example, there has been the problem of providing a motor having sufficient driving power for the spindles, which would, at the same time, be small enough to be economically built into the available space. The Superdraulic motor is especially designed to solve power-driving problems of this kind. It has ample power for most machine tool applications, yet is only 10 1/2 inches in diameter and light enough to be easily handled by one man.

The torque range of this motor is as high as 200 pounds-foot. The motor is available in two types, one rated at 26 1/2 gallons per minute at a pressure of 3500 pounds per square inch when operated at a speed of 1200 R.P.M.; the other at 19 gallons per minute at a pressure of 5000 pounds per square inch when operated at a speed of 1200 R.P.M.

This motor is said to have many operating advantages for industrial machine applications, including infinitely variable speed control, forward and reverse, by means of a finger-actuated volume-control valve; starting without clutches; and perfect control of acceleration and deceleration. Turbine smoothness is made possible by the unique design of the motor, which provides 66 power strokes per revolution of the driving shaft.

The Superdraulic motor is also especially well adapted for use in plants subject to fire hazards, such as explosive manufacturing factories, magnesium fabricating plants, and mills where there is a high dust content in the atmosphere. In such plants, hydraulic pressure generated by Superdraulic pumps located outside the danger area is readily transferred by means of tubing to the hydraulic motors used as direct-drive units in the plant. 99



Barnes Midget-size Solenoid

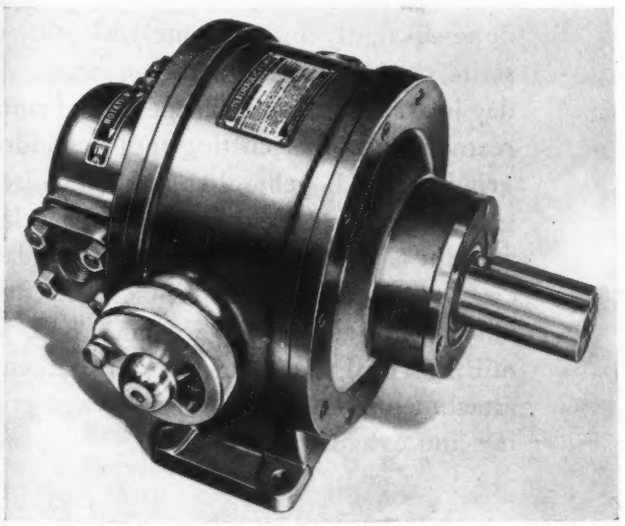
Barnes Improved Midget-Size Solenoid

Improved midget-size solenoids designed for long life and dependable service, which are adapted for operating auxiliary control valves, have been placed on the market by the John S. Barnes Corporation, 301 S. Water St., Rockford, Ill. Hammering action is said to have been entirely eliminated in these new solenoids. They have specially treated coils that are unaffected by oil or coolant. Extra heavy feet and side plates made integral with the body provide greater strength and rigidity. Phosphor-bronze plunger guides are employed to obtain better bearing surfaces.

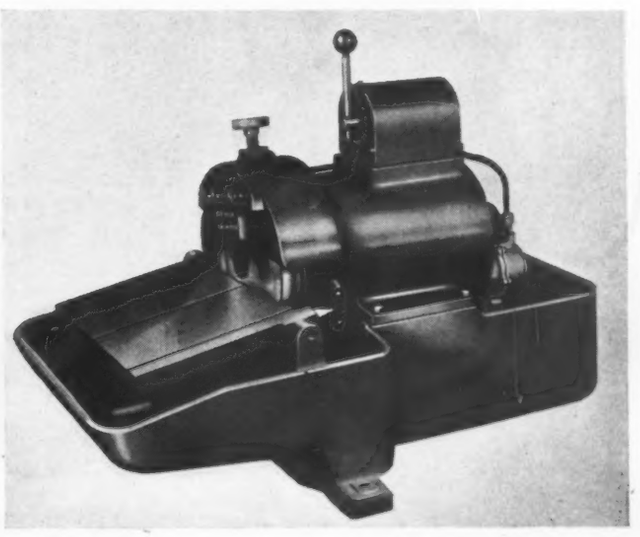
The solenoids are made in push and pull types. They will exert a pull of 4 to 7 pounds when extended between 1/4 inch and 1 1/8 inches. When the plunger is seated, the hold-in pull is between 13 and 15 pounds. At 110 volts, the inrush current is approximately 5 amperes, and the holding current 3/4 ampere. 100

Wickman-Neven Bench Grinding and Lapping Machine

A bench type grinding machine designed especially for sharpening carbide tools with a steel-bonded diamond wheel has been introduced on the market by the Wickman Corporation, 15533 Woodrow Wilson Ave., Detroit 3, Mich. This machine, known as the Wickman-Neven bench



Midget-size, High-power Hydraulic Motor Made by the Superdraulic Corporation



Wickman-Neven Bench Grinding Machine for Sharpening Carbide Tools

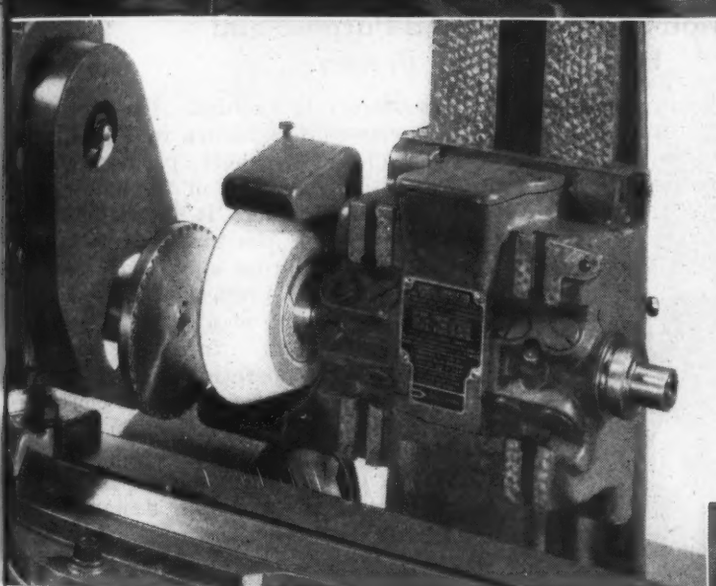
To obtain additional information on equipment described on this page, see lower part of page 234.

A versatile machine that does "fussy" jobs unusually well

No. 13
UNIVERSAL AND TOOL GRINDING MACHINE

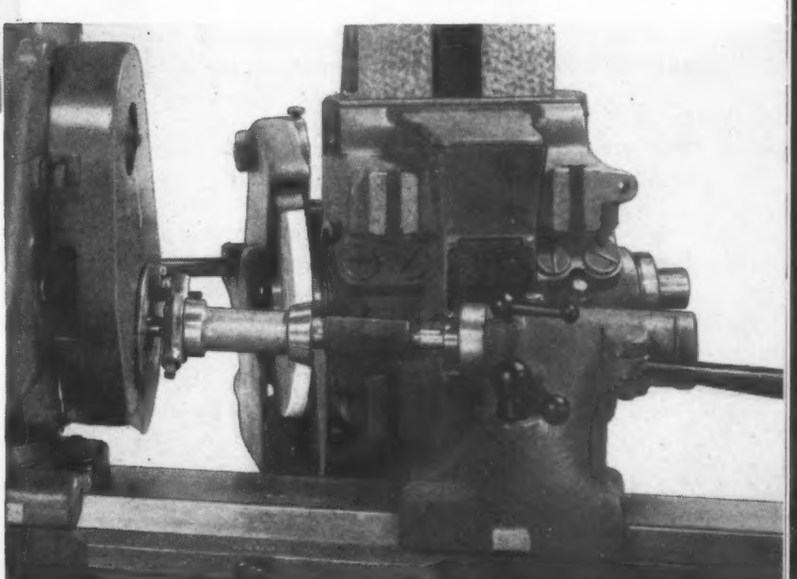
Here's a machine that saves time every working day. Set-ups and change-overs are made easily and quickly – work is done efficiently and accurately. Highly versatile, the No. 13 handles the common, every-day jobs such as rapid sharpening of cutters, reamers and other cutting tools, cylindrical grinding and general purpose toolroom grinding. For operations where a large amount of one type of work is required special attachments and equipment are available. This equipment includes hob, face mill, end mill, and formed cutter sharpening attachments – surface, internal, wet grinding and exhaust attachments.

BROWN &



The universal head with the swiveling adjustments of the table and of the wheel spindle upright, provides accurate settings for precise sharpening of a wide variety of cutters.

Thin work such as small saws, thin cutters, disks, washers, etc., which can be held in face chuck, are easily face ground by revolving-spindle grinding.



Either "live" or "dead" center grinding of cylindrical work . . . straight or taper . . . is equally easy. Wet grinding attachment, furnished as an extra, supplies coolant for grinding work up to 6" diameter.

Write for detailed specifications.
Brown & Sharpe Mfg. Co.
Providence 1, R. I., U. S. A.

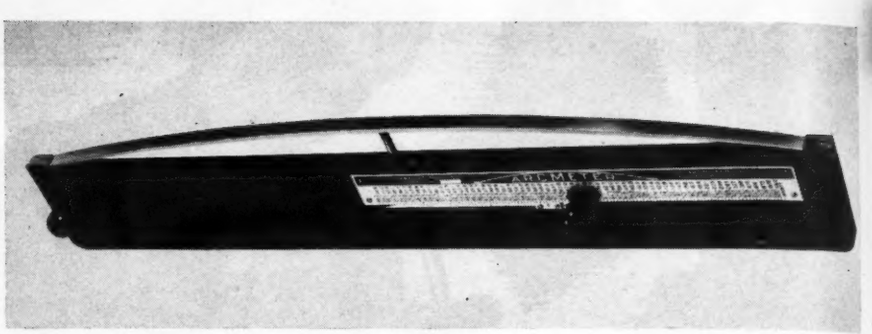
B·S

& SHARPE

grinding and lapping machine, has found wide acceptance in England, and is now available in the United States and Canada through the Wickman organization.

Ample power for full use of a steel-bonded diamond wheel is provided by the 1-H.P. spindle motor, which is specially designed to withstand frequent reversals. A coolant pump with a reservoir cast in the base of the machine is furnished as standard equipment.

For maximum convenience in sharpening both right- and left-hand tools, the direct-driven grinding wheel is reversed by a switch on the top of the motor. The wheel guard can be swiveled to either the right or left, and clamped in position by a thumb-screw. The 8- by 12-inch table can be quickly set to any angle from 5 degrees above to 15 degrees below the horizontal position. 101



"Arcmeter" for Drawing Arcs of Large Radii

"Arcmeter" Instrument for Drawing Arcs of Large Radii

An instrument designed to simplify the laying out of arcs of large radii and at the same time to increase the accuracy of such operations has been introduced on the market by the Arcmeter Co., 1025 Twenty-first Ave., Rockford, Ill. It can be used for scribing arcs in cases where the radius center is located beyond the limits of the drawing-board. Any desired radius within its range—from 34.2 inches to infinity—can be easily and quickly selected. The instrument is especially adapted for making up large-size scale lay-outs.

The flexible steel beam of the instrument is so designed that it will form a "perfect circle" at any radius indicated on the graduated scale. It can be easily adjusted by simply pushing the indicator knob to the graduation on the scale that designates the desired radius. The instrument is self-locking. The base is made of aluminum and has an Aluminite finish, which prevents marking or soiling of the drawing paper. 102

Watson-Stillman General-Purpose and Heavy Forming Presses

The Watson-Stillman Co., Roselle, N. J., has recently brought out a 40-ton general-purpose press and a 500-ton forming press equipped with an over-size die cushion. The general-purpose press, shown in Fig. 1, is designed for short production runs, testing purposes, or for hot or cold plastic molding. It is adapted for a variety of jobs that cannot be done economically on single-purpose equipment. This press can be used for metal-forming, straightening or bending, hobbing, forcing, and numerous other operations. A micro valve provides stepless pressure control through a range of from 25 per cent to maximum capacity.

The new 40-ton press is of four-column steel construction, designed to assure correct alignment. It is driven by a vane type pump, which gives a non-pulsating pressure and operates quietly. Finger-tip control is obtained by means of a hand-lever. A pressure gage is located in a convenient reading position. The double-acting rams permit the punches to be readily withdrawn when the press is used for plastic-molding or metal-drawing operations. Special controlling devices and steam or electric hot plates are optional equipment.

An over-size die cushion is the outstanding feature of the new self-contained 500-ton forming press shown in Fig. 2. The new cushion size adapts this press for larger and more varied loads. The surface dimensions of the cushion are 3 feet 4 inches by 3 feet 4 inches. The maximum tonnage rating of the press is 175. The stroke is 18 inches.

Fig. 1. Watson-Stillman General-purpose Hydraulic Press

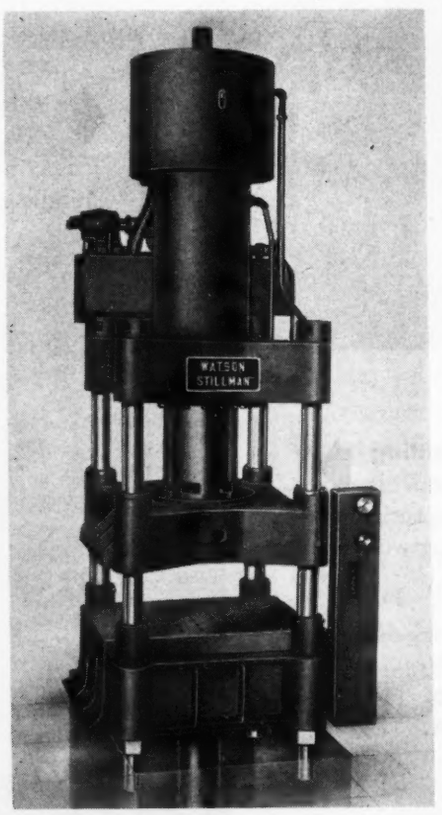
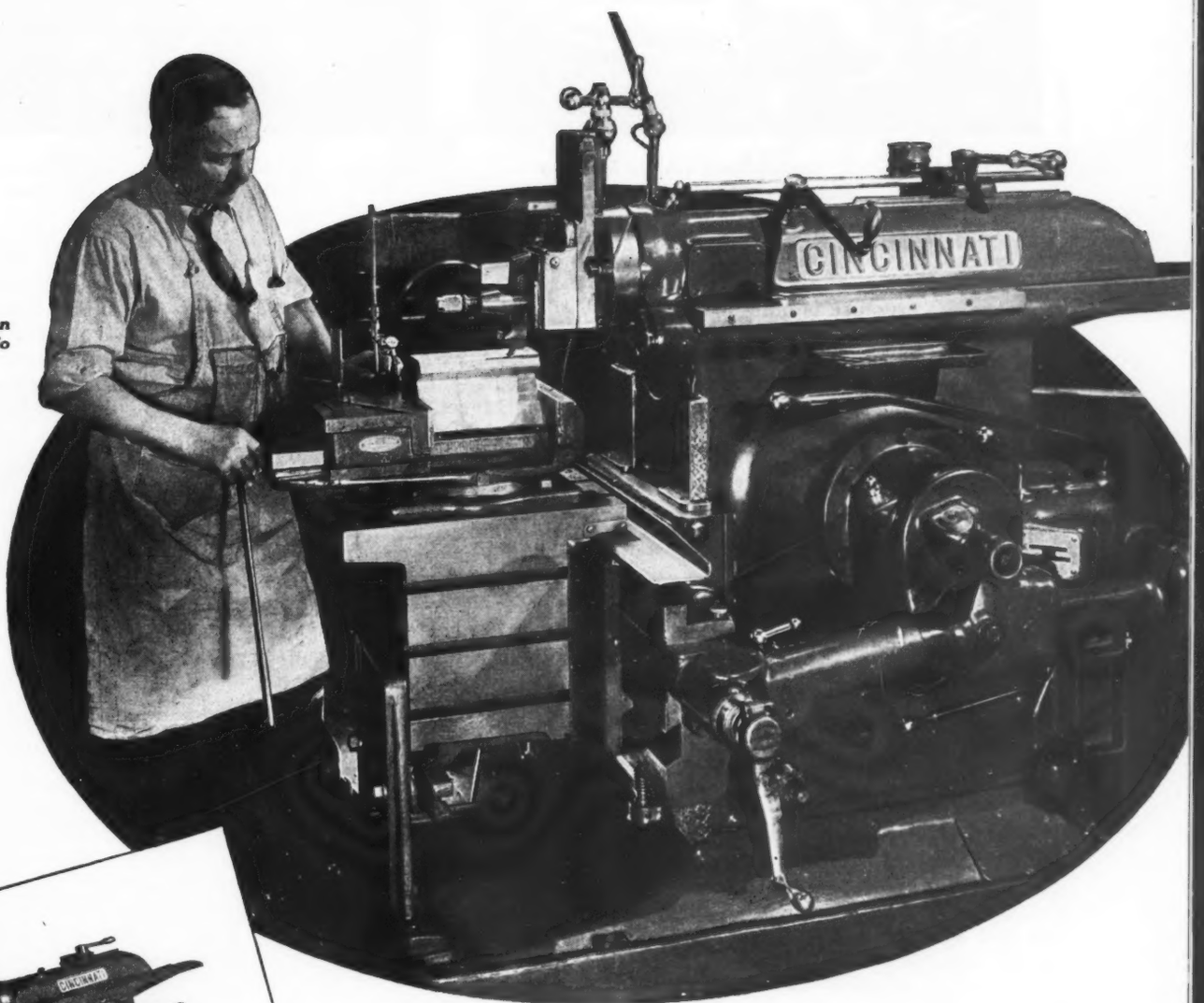


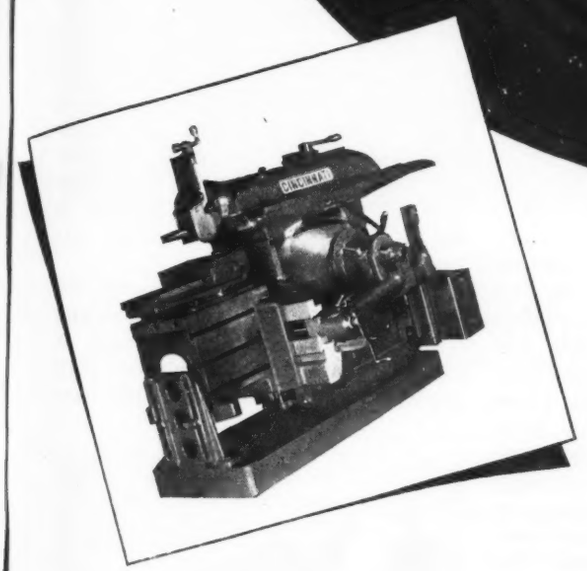
Fig. 2. Watson-Stillman Forming Press with Over-size Die Cushion

To obtain additional information on equipment described on this page, see lower part of page 234.

ACCURACY FIRST...



Courtesy of
The Sheffield Corporation
Dayton, Ohio



Accuracy is the first requirement where fine tools and gauges are built—their whole value lies in their accuracy.

In their production fine machines are needed for only fine machines can produce fine tools.

Cincinnati Shapers are found where jobs are most exacting—they are built to close tolerances, have reserve power and rigidity, and their smooth performance meets the demand for accuracy.

Write for Complete Catalog N-3.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

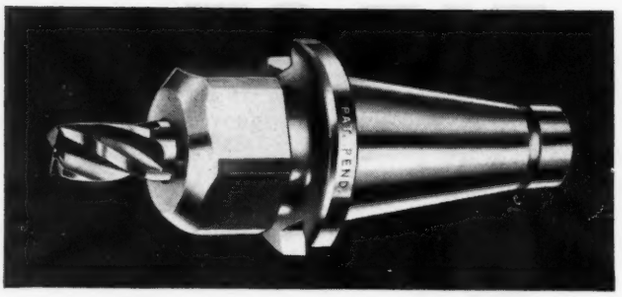


Fig. 1. "Selch" End-mill and Holder Made by Galanot Products Co.

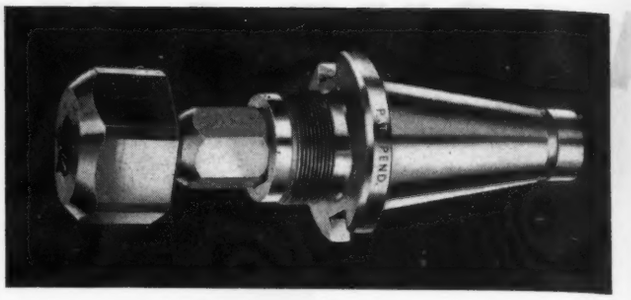


Fig. 2. End-mill and Holder Shown in Fig. 1 with Retaining Nut Unscrewed

This press has a working pressure of 2000 pounds per square inch. Control over the pressure is obtained by a single knob. Manual operation of the press is effected by a lever, and single-cycle automatic operation is obtained by a push-button. Reversal is pressure-controlled. The press ram advances and returns at a speed of 300 inches per minute. Compression speeds are 30 inches per minute for pressures up to 250 tons, and 8 inches per minute for pressures above 250 tons. The machine occupies a floor space of 7 by 6 feet and has an overall height of 18 feet 8 inches above the floor level, and a minimum pit depth of 6 feet. 103

"Selch" End-Mills and Holders

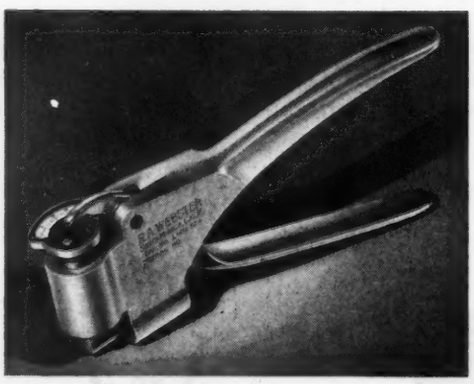
A new line of end-mills and holders designed to obtain maximum stability and insure concentricity of the tool with the machine spindle has just been placed on the market by the Galanot Products Co., 883 S. Union Ave., Alliance, Ohio. These end-mills can be used to machine smoothly finished slots to exact widths in one precision cut. The completely assembled holder and end-mill shown in Fig. 1 consists of the holder body with integral shank, the double-ended cutter or end-mill, and the heavy accurately machined hexagonal retaining nut.

In Fig. 2, the cutter is shown with one of its milling ends inserted in the holder and with its other end extending slightly beyond the face of the hexagonal retaining nut, which has been removed from the threaded end of the holder. Concentric precision grinding of the two tapered surfaces on the cutting tool, as well as the matching internal conical surfaces in the holder and retaining nut, serves to insure accurate concentric alignment of the cutter with the shank of the holder. The hexagonal section machined on the cutter between its cutting ends fits into the hexagonal cavity of the holder when the tool is assembled, and thus assures positive driving of the cutter. These cutters are now available in several sizes. 104

Webster Hardness Gages

Two new hardness gages—the Model B and the Model B-75—have been designed by R. A. Webster, 422 Twentieth St., Santa Monica, Calif., to accurately determine variations in hardness of aluminum and its alloys, as well as copper, brass, and other non-ferrous metals. These gages can be used to quickly and easily identify heat-treated materials, as distinguished from those that have not undergone heat-treatment, detect parts made from an unsuitable or sub-standard alloy; differentiate between soft and work-hardened materials; test materials for proper response to heat-treatment; and segregate material in stock. Both gages are small, portable, and easily operated by merely compressing the handles that actuate the penetrator.

The Model B gage gives direct hardness readings on aluminum alloys, and provides a dial reading of from 1 to 20, which covers the range from soft aluminum to heat-treated and aged strong aluminum alloy. The Model B-75 is designed for direct hardness readings on brass and other non-ferrous metals within the range of soft brass to full hard brass. It is similar in all respects to the Model B, except for the shape of the penetrator, which provides a somewhat greater sensitivity, but covers a shorter hardness range. The readings obtained on both these models can be easily compared with other standard hardness scales. Hardness tests can be made on stock of any thickness up to 1/4 inch. 105

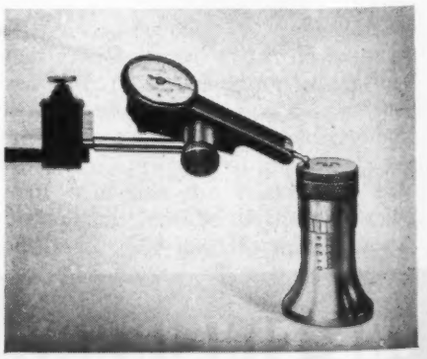


Webster Gage for Testing Hardness of Aluminum and Other Non-ferrous Metals

"Micro-Planer" Gage

A new inspection instrument, called the "Micro-Planer" gage, which serves as an adjustable master setting gage is being manufactured by the Accurate Machine Products Co., 1640 S. Hobart Blvd., Los Angeles 6, Calif. This gage has regular micrometer graduations of 0.001 inch and a positive locking device. The base of the instrument is parallel to the checking surface within extremely close limits.

This instrument is designed for setting cutting tools on planers and shapers; for making settings or measurements in conjunction with gage-blocks; for use with sine bars

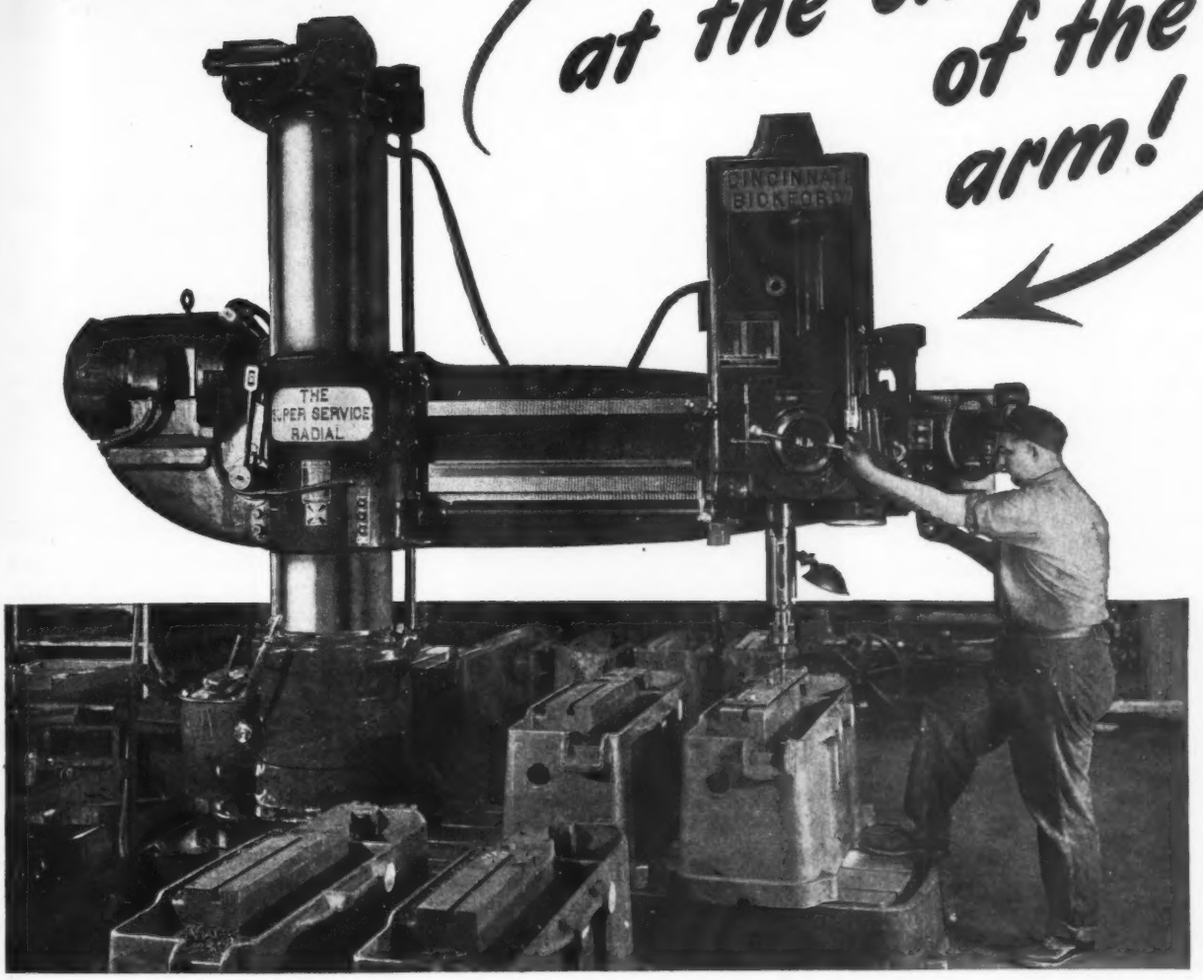


"Micro-Planer" Gage Made by the Accurate Machine Products Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

ACCURATE...

at the end of the arm!



Long bearing surface on the sturdy column and rigidity of the arm, plus the triple gibbed head mounting on arm, on Cincinnati Bickford Super Service Radial Drills insure accurate work even when the head is in extreme position at end of the arm.

Here setting up two castings at a time, and the convenient location of all control levers low on the job are speeding the job.

The machine answers easily to the touch of the operator—he spends less time on manipulation and more on production.

Write for Bulletin R-24A.

See our condensed catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.

in angle-grinding operations; or for use as an indicator for transferring measurements. It can also be used as a carriage stop for lathes, a drill press stop, or wherever a stop is required for accurate dimension control.

The gage has an adjustment range of 1/2 inch, which can be increased to 2 inches by means of extensions. All measuring surfaces are precision lapped and ground. The micrometer thimble has an adjustment by which compensation for wear can be made. The base of the gage is 1 1/4 inches in diameter, and the thimble is 7/8 inch in diameter. The height when closed is 1 1/2 inches, and when extended, 2 inches. 106

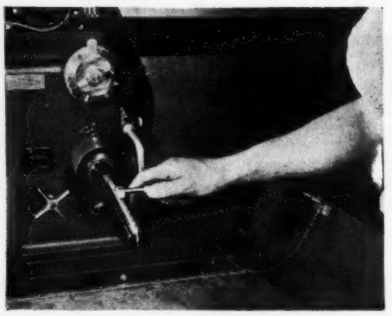
Kennametal Disk Type File

Kennametal, Inc., Latrobe, Pa., is now producing a disk type file for use on light alloys, die-castings, and plastics. This new tool is designed to facilitate the facing of rough castings and the removal of flash, draft, gates and risers, etc. It consists of double-cut segments of solid Kennametal, securely dovetail-wedged into a 12-inch diameter steel body which can be supported and driven by any suitable means. The teeth are formed and positioned so that the material is sheared off in clean-cut chips similar to those produced by regular Kennametal metal-cutting tools.

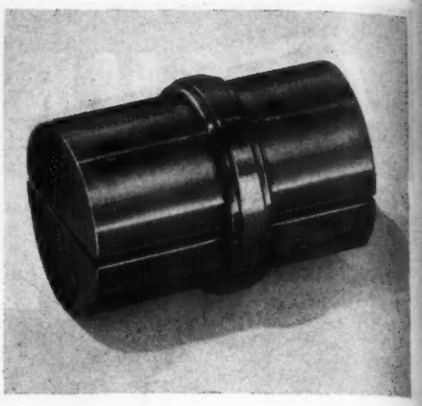
The file body can be attached directly to a rotating member of the driving machine by socket-head capscrews if it has a suitable supporting flange and centering stud. When such means are not available, a flanged adapter can be made for the purpose. It is claimed that this tool creates less heat in the work, makes possible increased production and removes material from the work in the form of chips that can be easily disposed of. 107

Sunnen Diamond Dressing Tool

A diamond dressing tool designed especially for use in keeping honing stones in efficient cutting condition has been developed by the Sunnen Products Co., 7940 Manchester Ave., St. Louis 17, Mo. This dressing tool is said to break the glaze quickly and restore cutting action without wearing the stone out-of-true or fracturing the bond. In dressing a stone, the tool is pulled very lightly over the full length of the surface to be dressed in one complete stroke. A chain hooked to a ring fastened to the end of the diamond dressing stick has a bracket at the opposite end which can be attached to the honing machine to insure having the tool at hand when needed. 108



Diamond Dressing Tool Developed by Sunnen Products Co.

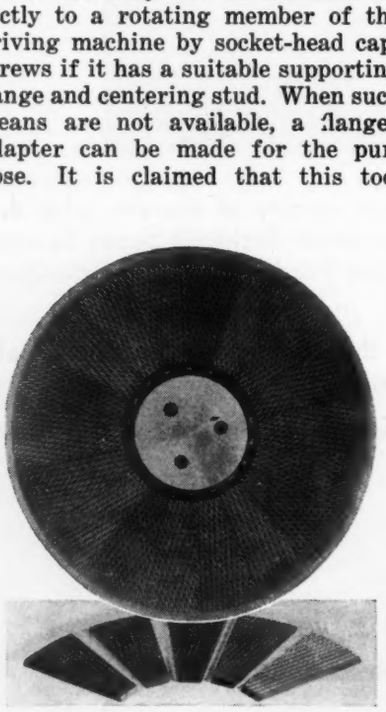


Expanding Work-holding Arbor Made by the Asco Corporation

with collet devices. The arbor is made in sizes of 3/8 to 1 inch, varying by 1/64 inch. The entire range of arbors is accommodated by three sizes of collets. Larger sizes are also available on order. 109

Sand-O-Flex Contour Sander

The Sand-O-Flex Corporation, 4373 Melrose Ave., Los Angeles 27, Calif., has added a Model 350-B "Sand-O-Flex" to its line of abrasive tools. This new brush-backed sanding wheel is practically a duplicate of the earlier Model 550-A, described in May, 1945, MACHINERY, page 214, but is smaller in diameter, being only 3 5/8 inches over the body portion and 5 1/2 inches in diameter over the brushes. The new wheel is lighter than the preceding model, weighing only 1 7/8 pounds. Eight replaceable brushes cushion the abrasive strip and provide the flexibility necessary for finishing irregular surfaces.



(Above) Assembled Kennametal Disk File. (Below) Kennametal Segments of Disk File

Asco "Auto-Arb" Work-Holding Arbor

The Asco Corporation, 874 E. 140th St., Cleveland 10, Ohio, has just placed on the market the Asco "Auto-Arb" shown in the accompanying illustration. This expanding type arbor has been designed to speed up production and certain manufacturing operations that require the work to be held on a revolving arbor. The design of the arbor permits the work to be chucked and released without stopping the spindle when the arbor is used on a screw machine or lathe equipped with a standard collet.

The arbor is designed to expand accurately and to maintain accurate centering with respect to the collet. It can be used to advantage on drill presses or milling machines equipped

Contour Sander Placed on the Market by the Sand-O-Flex Corporation

To obtain additional information on equipment described on this page, see lower part of page 234.

LEADERSHIP BASED ON ACCOMPLISHED FACTS...

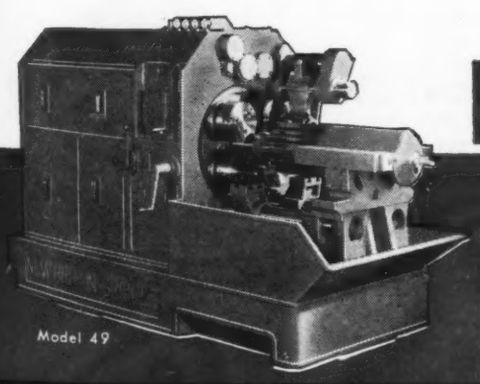
THE CASE OF THE CHUCKING MACHINE YEARS AHEAD OF ITS TIME

The New Britain Model 49 Four Spindle Automatic Chucking Machine was designed before the introduction of negative rake turning. Yet the standard model was used without modification on the first mass production job using negative rake tooling . . . cutting ball bearing races in S. A. E. 52100 steel at the rate of 450 to 720 S. F. M. on the outside diameter, several times faster than conventional turning permits. The end working tool feed advance is .012 per rev. and the cross arm tools .005 per rev. These forgings weighed 15.13 oz. before machining and weighed 8.91 oz. after machining, 6.22 oz. removed in 10 seconds.

This and other typical Model 49 jobs shown at the right indicate the versatility of New Britain Automatics, and the advantage of choosing machines that are years ahead of their time in engineering features.

- Variable chucking pressures, operating automatically and instantly adjustable.
- Electrically controlled, mechanically operated automatic safety devices.
- Hydraulically operated chucking mechanism.
- Swinging type forming arms.
- Wide open end construction.
- Automatic spindle carrier lifting mechanism.
- Positive drive synchro-mesh spindle clutches.
- Automatic spindle carrier clamping device.

For more, better parts per hour this year and *years from now*, it pays to pick New Britain.



Model 49

NEW BRITAIN

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

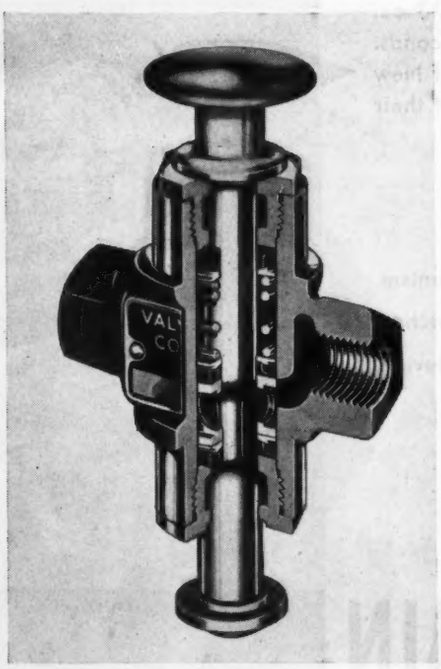
B-01044

This new wheel can be mounted on any electric motor shaft, a 1/6-H.P. motor on a 1/4-inch capacity electric hand drill providing adequate driving power. The recommended speed range is from 400 to 1750 R.P.M. It can be furnished to fit 1/2- and 5/8-inch shafts, and adapters for threaded spindles of any size can be supplied. 110

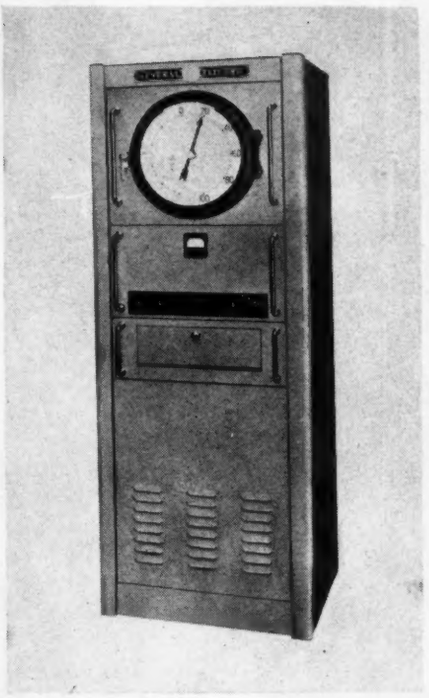
Valvair Control Valves

A complete line of control valves designed to operate on air pressures up to 200 pounds per square inch and at temperatures up to 120 degrees F., has been brought out by the Valvair Corporation, 454 Morgan Avenue, Akron 11, Ohio. This line of valves includes two-way, three-way, and four-way types in foot, cam, diaphragm, and solenoid-operated designs.

The illustration shows the internal design of a typical Valvair valve. The basic design of these valves embodies a sliding stem that moves through a series of specially constructed packers which seal the air in an "on" or "off" position without the use of metal seats. Non-corrosive materials are used in the manufacture of these valves to insure dependable operation and long life. The area through the valves is made equivalent to that of standard sized pipes to eliminate air flow restriction. The regular line includes valves in 1/4-, 3/8-, 1/2-, 3/4-, and 1-inch sizes. 111



Typical Air-control Valve Made by Valvair Corporation



Automatic Dewpoint Recorder Made by General Electric Co.

G-E Automatic Humidity Recorder

A dewpoint recorder which continuously and automatically records the humidity of gases has been announced by the apparatus department of the General Electric Co., Schenectady 5, N. Y. This recorder is designed for use where the moisture content of atmospheres and gases must be measured or controlled. It can be used for checking furnace atmospheres and testing city gas or determining the humidity of gases used in a variety of factory production processes.

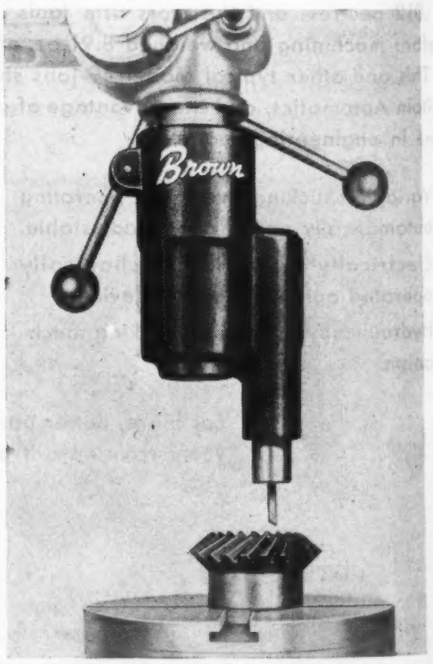
The dewpoint recorder is a combination of heater, refrigerator, mirror, and gas chamber. The gas to be tested enters the gas chamber, where it comes in contact with a metal mirror. The refrigerator and heater cool or heat the mirror until a temperature is obtained at which moisture in the gas forms dew on the mirror. A photo-electric eye is focussed on the mirror, and the mirror temperature is recorded on a graph or chart the moment dew forms.

Working in coordination, the refrigerator and heater hold this dewpoint temperature within a tolerance of 2 degrees, so that continuous reading on the chart is obtained. The recorded dewpoint temperature can be converted into the moisture content of the gas if desired. The recorder can be so arranged that it will flash or sound a warning when moisture in the gas reaches too high or too low a level, or control other equipment that will dehumidify or add moisture to the gas. The instrument is designed for operation at atmospheric pressure over a wide dewpoint range. After the initial installation, only minor adjustments are required to keep the recorder in continuous operation. 112

Brown Drill Press Filing and Slotting Attachment

Any size or make of drill press can be quickly and economically adapted for performing filing, cutting, sawing, or slotting operations through the use of the unit shown in the accompanying illustration. This unit, manufactured by the Leo G. Brown Engineering Co., 1157 Riverside Drive, Los Angeles, Calif., has only three moving parts, and can be attached to the drill press in three minutes.

Mounted between two preloaded ball bearings is a solid steel cam, which converts the drill press rotary motion to a vertical reciprocating motion and simultaneously increases the drill press power output. The main housing of the attachment consists of a Durometal casting with a bronze sleeve insert for the bearing surface. The cam roller is of hardened tool steel. This attachment is available in 1- and 1 3/4-inch stroke models. 113



Drill Press Equipped with Brown Filing and Slotting Attachment

To obtain additional information on equipment described on this page, see lower part of page 234.

NO MATTER WHAT YOUR PRODUCT MAY BE . . .

Ex-Cell-O's Complete Parts Production Facilities May Be of Practical Help to YOU!

Few people realize how extensive are Ex-Cell-O's facilities for the speedy production of quality parts. Yet the same wide experience, the engineering "know-how", and the outstanding accuracy that distinguish Ex-Cell-O machine tools and cutting tools wherever they are used . . . in many parts of the world . . . go into Ex-Cell-O's production parts manufacture.

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Fig. 1. Metal-cutting Tools with Clamped-on Advanceable Kennametal Tips

Kennametal "Clamped-On-Tip" Tools and Solid Grooving-Tool Blades

Kennametal, Inc., Latrobe, Pa., is now producing, for use on light machining jobs, two new types of tools having clamped-on advanceable Kennametal tips designed as shown in Fig. 1. Styles 1CL and 2CL tools have offset shanks, while styles 11CL and 12CL have straight shanks. Among the operating and maintenance advantages claimed for these new tools are more consistent performance and greater durability resulting from strain-free assembly; smooth unimpeded chip flow assured by correctly positioned clamping arrangement; exceptionally strong Kennametal tip, diamond-ground on the bottom face and firmly supported by the plane surface of a heat-treated steel shank; and tips that can be advanced and resharpened many times before discarding.

The shanks of these tools serve as permanent tip-holders and permit tips of different grades to be interchanged, thus adapting them for machining different types of metal. The Kennametal tips for these tools can be supplied with permanent molded-in chip-breaker groove of constant depth but adjustable in width by varying the amount ground from the end or side cutting edges. These tools are now available in 1 by 1 by 7 inches; 1 by 1 1/4 by 9 inches; and 1 by 1 1/2 by 10 inches. Tools of larger sizes can also be obtained for heavy-duty work.

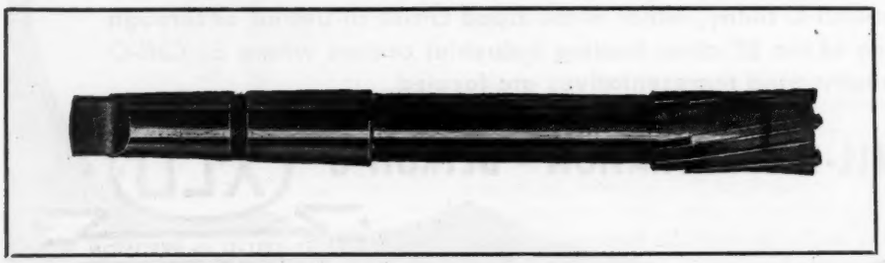
A line of solid Kennametal grooving-tool blades, of the design shown in Fig. 2, which are said to permit many more regrinds than the brazed-on-tip type tools is another new product of this company. An outstanding feature of these blades is their rigidity, a characteristic that minimizes the "weaving" action which has been a major cause of rapid wear on tools used for grooving operations. These new grooving-tool blades can be supplied in sizes to suit the user's requirements. Standard sizes now available include tools 1/2 inch high by 2 1/2 inches long, and 3/4 inch high by 4 inches long. They are supplied with a 10-degree angle formed on one end

Fig. 2. Kennametal Grooving-tool Blade

and with 2-degree clearance angles on each side, and are obtainable in widths made to the user's specifications within accuracy limits of ± 0.0005 inch. 114

Rogers Reamers

The John M. Rogers Tool Corporation, Gloucester City, N. J., has developed a new Type S reamer. This reamer combines a right-hand cut with a left-hand angle blade setting and a 5-degree negative face angle. These new reamers are made with straight shanks, as well as with taper shanks as shown in the illustration. 115

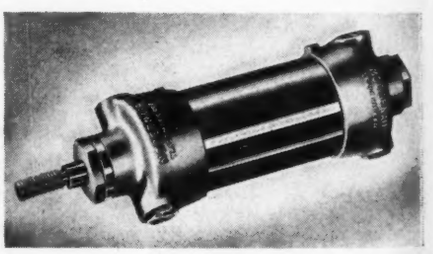


Reamer Developed by John M. Rogers Tool Corporation

Flexible Conduit for Machine Tool Installations, Made by Chicago Metal Hose Corporation

Flexible Conduit for Machine Tool Installations

In response to the specific needs of the machine tool industry, the Chicago Metal Hose Corporation, Maywood, Ill., has just added a synthetic-covered shielding conduit to its line of flexible metal hose. This new product, known as "Rex" machine tool conduit RT-25, was developed to meet the new machine tool electrical standards, in coordination with the Joint Industry Committee of Plant and Electrical Engineers, cooperating with the National Machine Tool Builders' Association. It has a galvanized steel, flexible, metal-hose liner and synthetic cover. This conduit is liquid-tight externally; can be used with both standard and watertight conduit boxes; and is furnished with fittings that are attachable and removable by the user, or permanently attached at the factory. 116

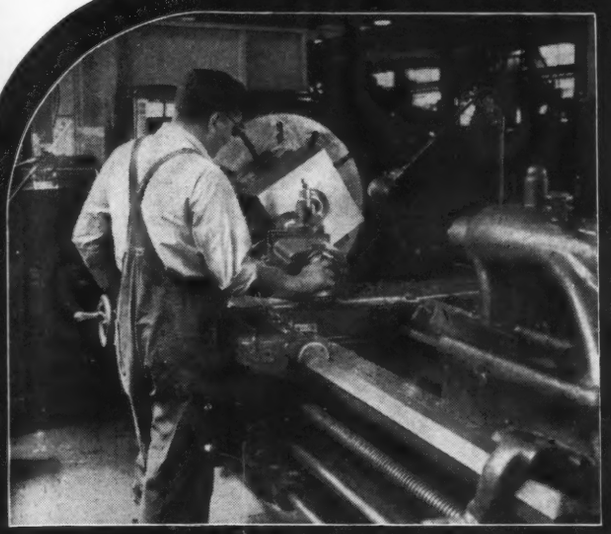


Cushion Type Cylinder Developed by Modernair Corporation

Modernair Cushion Type Cylinders

A cushion type cylinder with interchangeable mountings has been developed by the Modernair Corporation, 4222 Hollis St., Oakland 8, Calif., to meet a wide range of installation requirements. The new cylinder is corrosion-resistant, and

To obtain additional information on equipment described on this page, see lower part of page 234.



Sidney Lathes

★

TOOL & DIE WORK

★

COMPLICATED LATHE WORK

★

PLAIN TURNING

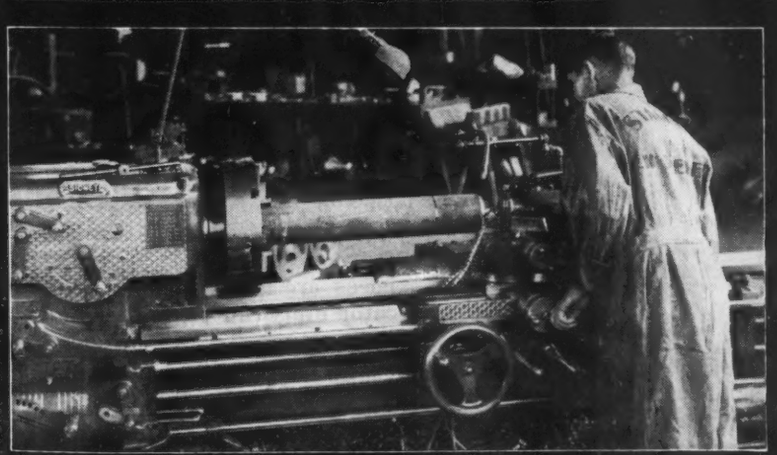
★

● The smooth flowing power of the continuous tooth Herringbone geared headstock, ease and convenience of controls, the rigidity of 4 wall bed construction all contribute to the accuracy, productive capacity and smooth finish obtained from Sidney Lathes.

They are also a few of the important construction features responsible for Sidney Lathe's adaptability to tool and die work—complicated lathe operations—or straight turning.

For all around utility—precision—and dependability make your next lathe a Sidney.

Bulletins on all sizes available



Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904

is adapted for actuation by air, water, or oil. It is designed to permit diversified use of the same cylinder. The standard design has a self-regulating cushion, but an adjustable cushion can be furnished.

The cylinder caps are heat-treated aluminum-alloy sand castings with high tensile and bursting strength. They can be rotated a full 360 degrees on the cylinder without disturbing the seal. This feature simplifies installation, and generally eliminates the need for elbow or tee fittings in pipe lines leading to or from the cylinder. The cylinder caps are designed to take any one of a number of mounting brackets, including end plates, swivel mountings, and foot types.

Aircraft Type O ring packings are used throughout the cylinder at all points of wear or possible leakage. The swivel mounting is particularly noteworthy in that a combination thrust and elevation motion can be obtained by its use. Since all brackets are interchangeable, the basic cylinder can be used in widely different applications by making simple changes in the mountings. The cylinders are available in diameters of 2, 3, 4, 5, and 6 inches. 117

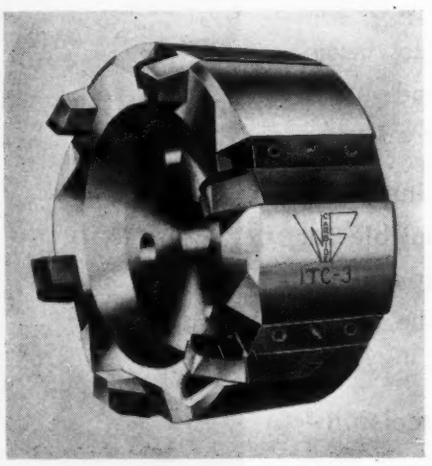
Drill for Cutting Hardest and Softest Metals

The Enesay Tool Co., 2240 Sepulveda Blvd., Los Angeles 23, Calif., has developed a new drill which, it is claimed, will cut through intensely hard and very soft metals with equal facility. This tool will readily drill through steel heat-treated to a hardness of 68 Rockwell C, which is somewhat harder than file steel. The new drill thus makes possible fast precision drilling on metals so hard that such operations were previously considered impractical. It frequently eliminates the need for internal grinding, since it is designed for precision drilling and reaming to extremely close tolerances. Expensive steel parts in which errors or changes in design make necessary the drilling of new holes can often be salvaged after hardening by the use of this drill.

The drill is constructed of a new alloy which causes only the metal removed to be softened during the drilling operation, while the surrounding metal remains unaffected. The tensile strength of the drill is more than 45,000 pounds per square inch, and it is claimed that only extreme carelessness in handling will cause it to break. It is available in all standard and special sizes. 118

Wendt-Sonis Milling Cutter with Interchangeable Carbide Blades

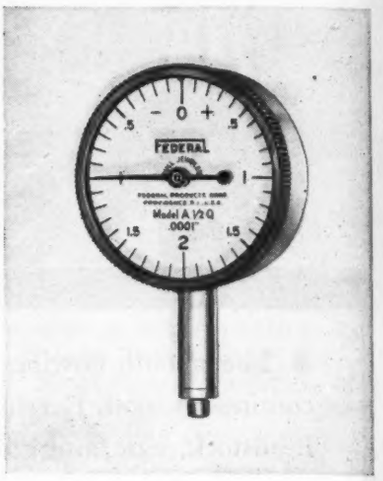
An inserted-tooth carbide cutter with blades that are interchangeable to accommodate any type of milling job has been placed on the market by the Wendt-Sonis Co., Hannibal, Mo. The cutter is said to require less power than ordinary cutters, and is readily adaptable for use on standard machines.



Wendt-Sonis Milling Cutter with Interchangeable Carbide Blades

Enesay Drill Developed to Cut Hardest and Softest Materials

This new cutter has a safety feature in the form of a special type wedge which prevents the blades from slipping out while in operation. When the blades require sharpening, they can be easily removed from the cutter body and ground on an ordinary bench grinder, no special equipment being required. 119



Small-size Dial Indicator Made by Federal Products Corporation

Federal Small-Size Dial Indicators

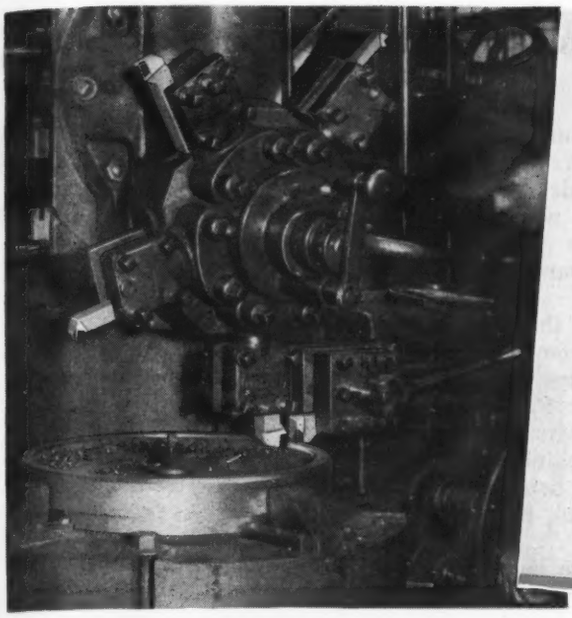
Three new dial indicators have been placed on the market by the Federal Products Corporation, 1144 Eddy St., Providence 1, R. I., to meet the demand for small-size compact instruments. The over-all bezel diameter of the new A models is only 1 1/4 inches. They are designed for use where there is insufficient room to permit the use of a large indicator or where weight is a factor, as in the case of portable equipment.

The entirely new movement provided in these indicators has the same low-friction, full-jeweled features of the regular size Federal indicators. These instruments are designed to give exceptional accuracy on repetitive gaging work and long service. They are designated A1/2Q, A3Q, and A6Q-2, and have 0.0001-, 0.0005- and 0.001-inch graduations, respectively. The American Gage Design Committee (AGD) bracket type back is regularly furnished, but post or flat type backs and special backs are also available. The indicator dials can be rotated to obtain zero settings. 120

* * *

The dial telephone set has 429 different parts.

To obtain additional information on equipment described on this page, see lower part of page 234.



5 BIG REASONS WHY CARBOLOY CEMENTED CARBIDE STANDARDS get the call IN DIESEL MANUFACTURE

In the progressive Diesel field—where boosting product efficiency, increasing output, and reducing costs are continuing objectives of front-rank importance—more and more companies are turning to Carboloy Cemented Carbides. Here's why:

1 THEY PARE COSTS
2 BOOST HOURLY OUTPUT

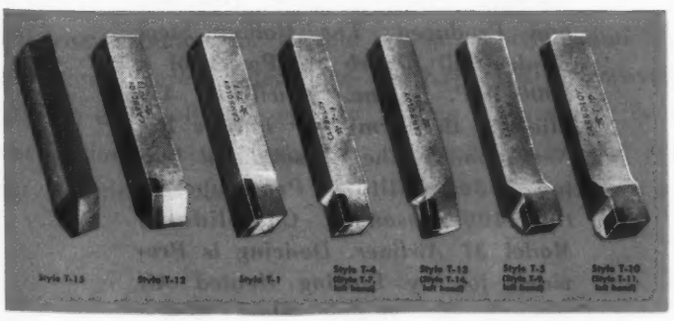
Eight single-point Carboloy* tools replaced an equal number of large, expensive core drills on one operation in Diesel engine manufacture with these results: Cost of new tooling was cut from $240 per set-up to $15. Hourly production was doubled. Direct labor cost per connecting rod was halved.

3 OUTLASTS STEEL TOOLS
4 ELIMINATE EXTRA OPERATIONS

A midwestern manufacturer of Diesel valves switched to Carboloy* Standards for machining the interiors of valve heads. A far smoother surface finish was obtained—the polishing operation was completely eliminated, with a big saving of time—and tool life was increased by 10 times.

5 AND DO THE JOBS THAT "CAN'T" BE DONE!

Recently a shipyard ran into trouble reconditioning Diesel crankshafts on ships of war. The chrome alloy used to build up undersize bearings proved too tough and abrasive for high speed steel, and diamond-pointed tools were too fragile and costly for the job. Lacking a grinder big enough for the operation, Carboloy* G-999 was recommended—machined satisfactorily at moderate tooling cost—and helped speed the needed ships back into service.



Put Carboloy* Standards to work in *your plant*, for greater stamina throughout long production runs—high piece-output-per-tool—high surface finish, almost mirror-smooth—uniformly close tolerances—cutting edge maintained longer between grinds. In every industry these 11 Standard Styles are adaptable to 60%-80% of the turning, facing and boring jobs. They are actually priced lower than ordinary tools in many sizes. Write today for Catalog GT-175R.

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New Method of Preparing Bearing Shells for Babbitting

Years ago when babbitted bearing shells were generally made from cast iron, a series of dovetail slots were cut into the bore of the shells prior to pouring the babbitt. This was done because babbitt, being composed largely of tin and lead, cannot be bonded readily to cast iron, and the slots were required to assure the firm anchoring of the babbitt lining in the shell.

Later, as there was a transition from the use of cast iron to steel and bronze for bearing shells, these slots were dispensed with in the smaller-sized bearings. In the larger bearings, however, the slots were still used as an additional safety factor to insure that the babbitt lining would not loosen from the shell.

According to A. A. Goodman, of the Steam Division of the Westinghouse Electric Corporation, South Philadelphia, Pa., early in the war the importance of saving both man- and machine-hours, in addition to the critical shortage of tin, resulted in the development of a new idea in preparing shells for babbitting. Instead of cutting slots, the bore was serrated with grooves similar to screw threads. These serrated bores presented a great deal of surface for the bonding of the babbitt. Usually, the serrations were made twelve to the inch, and the depth was such that the bonding surface was increased 50 per cent, compared with the smooth bore.

The saving in babbitt that formerly filled the dovetail grooves was considerable, and the saving in tin was particularly important. Furthermore, the dovetailing operations performed in the slotting machine were eliminated, the entire bore being finished in the lathe or boring mill at one set-up.

These serrated bores are now being used at the Westinghouse South Philadelphia plant on all bearings except those made of cast iron and aluminum bronze. The latter cannot be bonded to babbitt without being subjected to special salt bath treatments or electroplating.

* * *

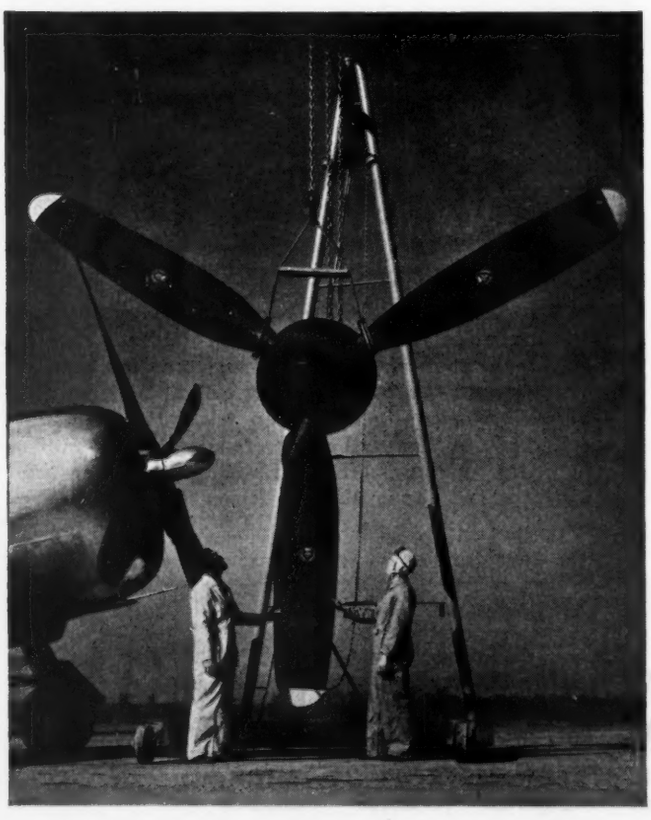
An airplane transport pilot must keep track of over one hundred different instruments, whereas the average automobile driver has only six to watch.

New Scribing Plate for Optical Comparators

A new engineering material known as "Kodak Green Scribing Plate" has been developed by the Eastman Kodak Co., Rochester, N. Y., for use with optical comparators of the contour projection type. Plates of this material are used either directly with the contour comparators or as printing masters for photographically duplicating the contour comparator plate. They can also be used for making small photo templets on metals, plastics, and other materials.

The new scribing plate consists of a transparent green-dyed gelatin coating applied to glass. Tolerance lines are scribed on the plate by cutting through the gelatin film. The use of these plates eliminates the need for employing hydrofluoric acid for the etching of glass plates.

The plate provides an easy means of accurate reading. By using a supplemental red light behind the plate, the tolerance limits in shadowed areas are brought into sharp relief, showing as red lines against the dark green background. On precision grinding machines equipped with contour comparators, this permits the operator to see exactly how much material must be cut away.

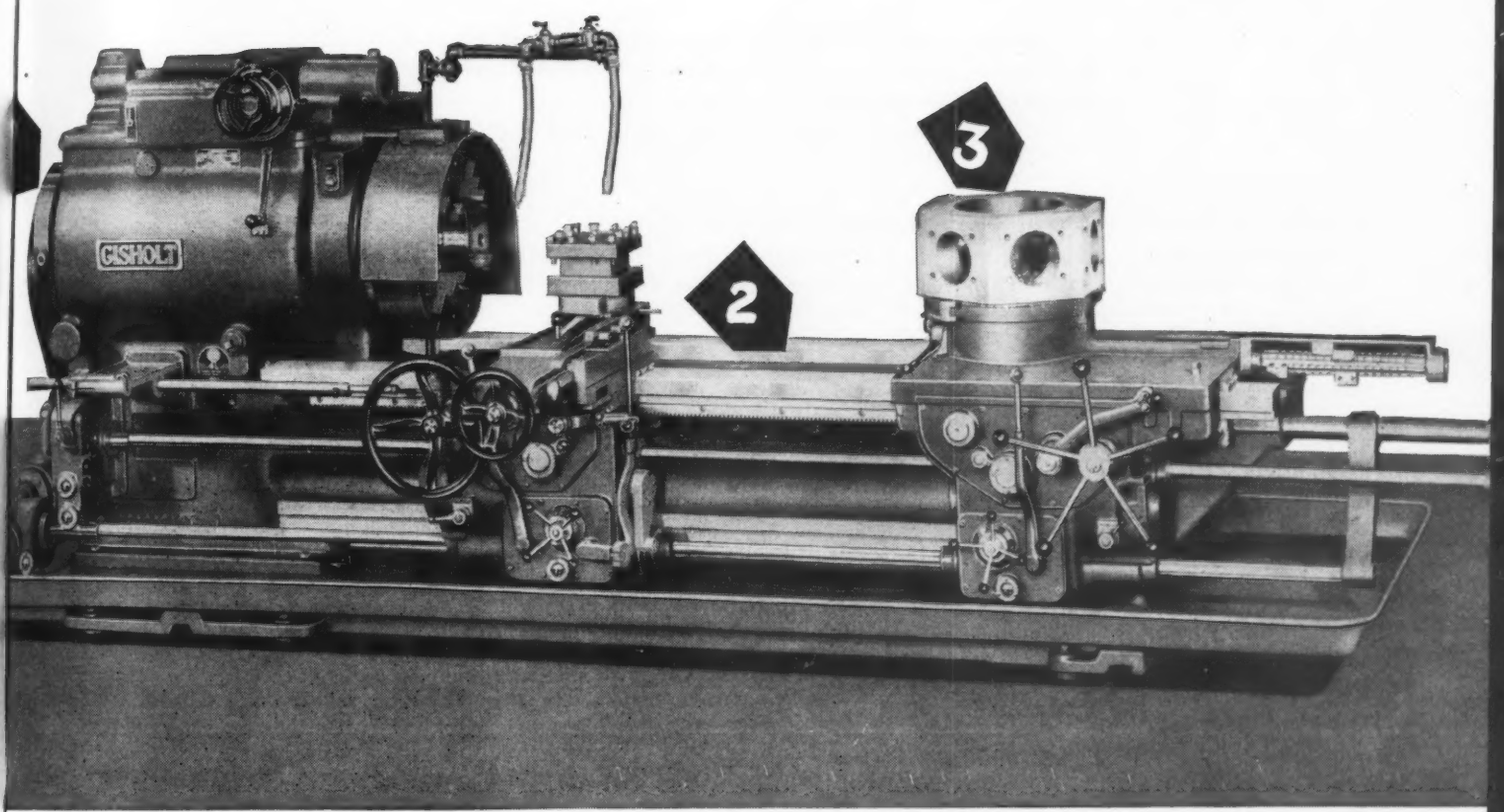


A Giant Curtiss Aircraft Propeller Measuring 19 Feet in Diameter. This is Said to be the Largest Aircraft Propeller ever Designed and Produced. The Hollow Steel Blades will Absorb the Power of a 3000-H.P. Engine. It will be Applied to the Army Air Force's Big New Bomber, the Consolidated Vultee B-36, Military Prototype of the 400-passenger Consolidated Model 37 Airliner. De-icing is Provided for by Passing Heated Air through the Hollow Steel Blades

Why Gisholts retain their ACCURACY!

Accuracy is vital in a turret lathe. Would you be satisfied to have it for only a year—or two—or five?

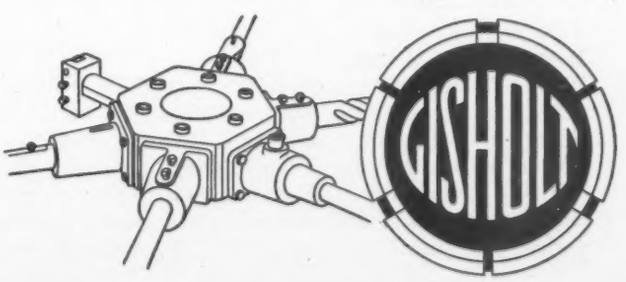
Because experienced users want accuracy to last the life of the machine, we have incorporated these and many other refinements in the design and construction of Gisholt Turret Lathes. We believe, as do Gisholt users, that they more than pay for themselves in greater speed, better performance, less maintenance and lifelong accuracy.



1 Headstock is cast integral with bed for extreme rigidity—to insure accurate, permanent alignment. The heavy forged steel spindle with flanged nose, mounted in double row precision tapered roller bearings at both ends, will carry heavy work at maximum speeds and feeds without deflection or chatter.

2 Bed ways are of thick block type tool steel, hardened to 64-66 Rockwell C and finish-ground in exact alignment with the spindle. On top, bottom, and both sides these hardened steel ways present a bearing surface that is virtually wearproof. Automatic pressure lubrication preserves their accuracy.

3 Permanent alignment of the hexagon turret is insured by its massive rigidity, the large bearing surface of the carriage on the hard steel ways with square lock gib construction, and long guide. The turret is accurately positioned in index and rigidly clamped with a powerful, cam-operated binder.



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Machining Stainless Steels

CARPENTER STEEL CO., 105 W. Bern St., Reading, Pa. Publication entitled "Notebook on Machining Stainless Steel," containing a fund of useful information designed to simplify the machining of stainless steel and provide longer tool life, higher speeds, and better finishes. Production and management executives can secure personal copies without charge from the nearest Carpenter representative; additional copies available at 50 cents each.

Decimal Equivalent Chart

RUTLAND TOOL SERVICE, 13006 Greeley Ave., Detroit 3, Mich., is distributing a 9 by 11 decimal equivalent chart which can be obtained without charge if requested on a company letter-head, addressed directly to Rutland Tool Service.

Interchangeable Punches and Dies

RICHARD BROTHERS DIVISION OF ALLIED PRODUCTS CORPORATION, 1560 E. Milwaukee Ave., Detroit 11, Mich. Catalogue FF, giving descriptive information and technical data on standardized interchangeable punches and dies, including die sections, guide pins, bushings, dowel-pins, stripper bolts, and diemakers' supplies. 1

Gears, Speed Reducers, and Flexible Couplings

D. O. JAMES MFG. CO., 1140 W. Monroe St., Chicago, Ill. Catalogue 1000 (575 pages), covering cut gears, gear speed-reducing transmissions, and flexible couplings, together with a 100-page engineering section containing tables, charts, and formulas useful in solving gear design problems. 2

Bronze Electrode Data

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. "Comparative Bronze Electrode Chart," containing AWS-ASTM classification of bronze electrodes and the grade numbers of arc-welding rods made by fifteen manufacturers which meet various classifications. Bulletin W-9, on shielded-arc alternating- and direct-current bronze electrodes. 3

Universal Drafting Machines

UNIVERSAL DRAFTING MACHINE CO., Cleveland 14, Ohio. Catalogue illustrating and describing the "Boardmaster," a new universal drafting machine with special features designed to give greater accuracy and more efficient and convenient control. 4

Turret Lathes and Automatics

GISHOLT MACHINE CO., 1209 E. Washington Ave., Madison 3, Wis. Folder entitled, "Look Ahead—Keep Ahead with Gisholt," briefly listing the company's lines of turret lathes, automatic lathes, balancing machines, and superfinishing machines. 5

Die-Casting Machines

HYDROPRESS, INC., 570 Lexington Ave., New York 22, N. Y. Circular L-24-E, descriptive of a new design of full-hydraulic "Hydrocast" cold-chamber die-casting machines for casting alloys of copper, aluminum, magnesium, and zinc. 6

Recently Developed Metals and Alloys

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh 30, Pa. Guide to the properties and applications of eighteen recently developed metals and alloys for the electrical and mechanical industries. 7

Dial Indicator Gages

L. S. STARRETT CO., Athol, Mass. Third edition of the Starrett dial indicator catalogue, covering the company's complete line of dial and other indicator gages; includes American Gage Design Committee specifications. 8

Disk Clutches

TWIN DISC CLUTCH CO., Racine, Wis. Publication entitled "Production Road—Application Issue," covering heavy-duty, machine tool, farm tractor, and air-actuated clutches, reduction gears, and hydraulic couplings. 9

Plastics

BAKELITE CORPORATION, UNIT OF UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York 17, N. Y. Booklet entitled "The ABC's of Modern Plastics," briefly outlining the origin, preparation, and uses of plastics. 10

Steel Shop Equipment

STANDARD PRESSED STEEL CO., Box 22, Jenkintown, Pa. Catalogue 602, covering the Hallowell line of steel shop equipment, including cabinets, bench legs, chairs, stools, desks, work-benches, tables, tool-stands, etc. 11

Coated Heat- and Moisture-Resistant Fabrics

E. I. DU PONT DE NEMOURS & CO., INC., Wilmington, Del. Catalogue showing varied applications of "Fairprene," a coated fabric that resists heat and cold, oils, chemicals, sunlight, abrasion, and flexing. 12

Engineering Service

PIONEER ENGINEERING & MFG. CO., 19669 John R. St., Detroit 3, Mich.

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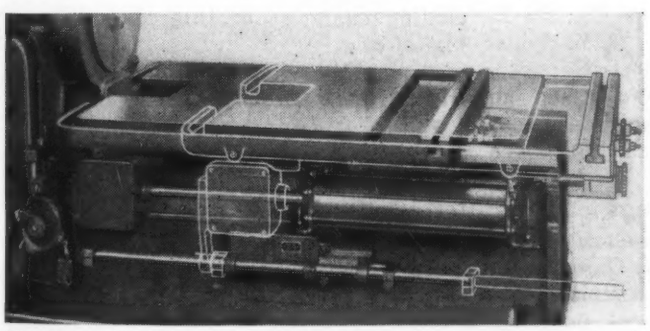
...FOR HEAVY, FAST PRODUCTION

SIMPLIMATIC TOOLING

is supported by solid metal from the floor up!



THE SIMPLIMATIC PLATEN TABLE rests on and against hardened and ground steel ways and gibs. It has a fast, smooth traverse to and from cutting position, actuated by pneumatic cylinders.

VERTICAL HEAD TOOLING can be arranged instead of on horizontal platen table when desired. Here, too, you have maximum rigidity and solid support for tools right to the cutting edge.

The heavy platen table of the Simplimatic automatically locks after it traverses to cutting position. Thus it and all the tooling on it become virtually one piece with the bed.

Because of the freedom in positioning slides on the big platen table, tools can be held close to their cutting edges and favored in any way desired. Moreover, this freedom from chatter is permanent because slide top is mounted on hardened steel ways and gibs.

Combined with the solidity of the cutting tools is the precision-fitted spindle of large diameter, on widely spaced roller bearings and its large herringbone drive gear mounted close to the nose. There's no chance anywhere for vibration. Chatter is *designed out!*

That's why Simplimatics can hold to extremely close tolerances, on large parts and at high production speeds. Ask for complete information about the Simplimatics.

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Catalogue entitled "The Answers to Industry's Problems," outlining the services in research, engineering, accounting, and production offered by this concern. 13

Pneumatic Tools and Shop Equipment

IDEAL INDUSTRIES, INC., 1011 Park Ave., Sycamore, Ill. Catalogue MTC, on this company's line of machinery products, including pneumatic tools, dust collectors, centers, etchers, chucks, surface plates, etc. 14

Heat-Treatment of Stainless Steels

PETER A. FRASSE & CO., INC., 17 Grand St., New York 13, N. Y. Data Chart A-6, presenting the essential facts on the heat-treatment of stainless steel, tabulated for convenient use. 15

Milling Attachments

H. LEACH MACHINERY CO., 387 Charles St., Providence 4, R. I. Bulletins on Fray "all-angle" milling attachments, offset boring heads, and ram type vertical universal milling machines for which this company is national distributor. 16

High-Temperature Insulating Varnish

DOW CORNING CORPORATION, Midland, Mich. Resin Series No. 1, describing the methods of using DC 996, a high-temperature silicone insulating varnish that cures at low temperatures. 17

Resistance Welding

SCIAKY BROS., INC., 4915 W. 67th St., Chicago, Ill., is distributing a new monthly publication entitled "Resistance Welding at Work," which will describe various interesting problems in resistance welding fabrication. 18

Arc-Welding Electrodes

METAL & THERMIT CORPORATION, 120 Broadway, New York 5, N. Y. 92-page catalogue covering applications, characteristics, physical and chemical properties, and recommended welding procedures for Murex arc-welding electrodes. 19

Protective Coatings

UNITED CHROMIUM, INC., 51 E. 42nd St., New York 17, N. Y. Booklet giving data covering the sources, properties, and applications of the many resins used in synthetic lacquers and protective coatings. 20

Roll Grinding

NORTON CO., Worcester 6, Mass. Booklet containing important information on roll grinding including selection of wheels, factors affecting results, and definite instructions for grinding various types of rolls. 21

Hydraulic Pumps

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin illustrating and describing the principles of operation and applications of the Sundstrand hydraulic circuit control pump. 22

Metal Fabricating Short-Cuts

DOALL CO., 1301 Washington Ave., S., Minneapolis 4, Minn. 22-page booklet entitled "DoAll = 10+," graphically illustrating numerous metal fabricating short-cuts performed on DoAll machines. 23

Arc-Welders

HOBART BROTHERS CO., Hobart Square, Troy, Ohio. Catalogue descriptive of the new Hobart 200-ampere gas-engine drive arc-welder. Circular entitled "Hobart Pocket Check List of Welders' Needs."....24

Electrode Selection Chart

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Four-color 25- by 40-inch electrode selection chart, designed to assist in choosing the right electrode for a specific job. 25

Precision Ball Bearings

JACK & HEINTZ PRECISION INDUSTRIES, INC., Cleveland 1, Ohio. Catalogue 2000, containing complete data on the company's line of precision ball bearings, including rated bearing loads. 26

Printing and Developing Machines

CHARLES BRUNING CO., INC., 4754 Montrose Ave., Chicago 41, Ill. Circulars containing specifications on the Bruning Model 40 BW printer and the Model 158 developer. 27

Tachometers

HERMAN H. STICHT CO., INC., 27 Park Place, New York 7, N. Y. Bulletin 798, descriptive of an extra large stationary tachometer, designed for applications where visibility and readability are important. 28

Welding Rod Selector Chart

EUTECTIC WELDING ALLOYS CORPORATION, 40 Worth St., New York 13, N. Y. Welding rod selector chart, giving detailed information on the properties of welds and welding procedure instructions. 29

Welded Products

LUKENWELD, INC., DIVISION OF LUKENS STEEL CO., 279 Lukens Bldg., Coatesville, Pa. Comprehensive descriptive bulletin entitled "Weldments Designed and Fabricated by Lukenweld." 30

Pneumatic Tools

KELLER TOOL CO., Grand Haven, Mich. Catalogue 12, on pneumatic drills, nut-setters, screwdrivers, grinders, chipping hammers, riveting hammers, compression riveters, air hoists, and air motors. 31

Vibration Isolation

AMERICAN FELT CO., Glenville, Conn. Data Sheet No. 10, on vibration isolation with felt "Vibramounts," presenting basic information on solving vibration problems in mounting machinery. 32

Thread Gages

JOHNSON GAGE CO., 534 Cottage Grove Road, Bloomfield, Conn. Publication containing engineering data on the gaging of screw threads, including examples of this company's line of gages. 33

Industrial Furnaces

W. S. ROCKWELL CO., 200 Eliot Ave., Fairfield, Conn. Bulletin 424, on Rockwell revolving-retort furnaces for annealing, hardening, and drawing of ferrous and non-ferrous metal products. 34

Extruded and Rolled Metal Products

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 64B, on extruded rounds and shapes, rolled metal sheets, hollow bars, and swaged rods of Ampco metal.....35

Stainless-Steel Welding Electrodes

JESSOP STEEL CO., Washington, Pa. Catalogue containing information on the selection and application of Jessop stainless-steel welding electrodes. 36

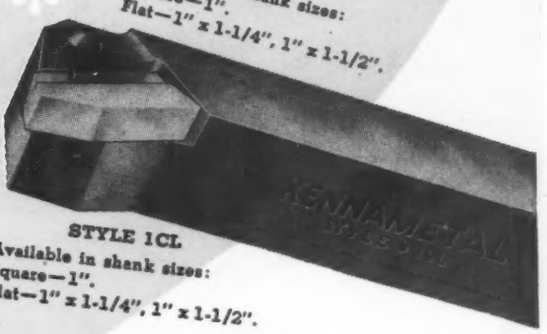
Industrial Rubber Products

B. F. GOODRICH CO., Akron, Ohio. Booklet on rubber belting, hose, hose couplings, packing, rubber linings, industrial clothing, rubber gloves, and various other industrial rubber products. 37

NOW—New* Clamped-on Tip KENNAMETAL TOOLS FOR LIGHTER MACHINING JOBS

STYLE 11HD
Available in shank sizes:
Square—1-1/4", 1-1/2", 2".
Flat—1" x 2", 1-1/2" x 2".

STYLE 11CL
Available in shank sizes:
Square—1".
Flat—1" x 1-1/4", 1" x 1-1/2".



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Available in shank sizes:
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STYLE 12HD
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Flat—1" x 2", 1-1/2" x 2".

STYLE 12CL
Available in shank sizes:
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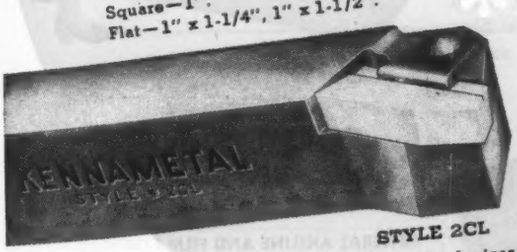

STYLE 2CL
Available in shank sizes:
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TWO new styles of tools—straight and offset shanks—with clamped-on Kennametal tips, have been developed so that the outstanding operating and maintenance advantages that characterize our now well-known HD line for heavy duty work, may also be realized on lighter machining jobs. Among the advantages provided by these new tools are:

More consistent performance and greater durability from thermally strain-free assembly;

Smooth, unimpeded chip flow assured by perfected clamping arrangement, correctly positioned;

Exceptionally strong Kennametal tip—diamond ground on bottom face—firmly supported by plane surface of heat-treated steel shank;

Dull tips can be advanced, resharpened time and again, and major part utilized—tip only is reground;

Fewer tools to stock—many tips can be used during life of one shank;

Tips of different grades can be clamped in same shank;

Tips can be supplied with permanent, molded-in chip breaker, constant in depth, but adjustable in width by varying amount ground from end, or side cutting edges.

Illustrations show the new styles, as well as the widely used HD style, of clamped-on-tip Kennametal tools. Captions indicate sizes available.

SEND TODAY FOR SUPPLEMENT 2 . . .

. . . of Catalog 45, for complete specifications and prices.

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL Inc., LATROBE, PA.

Are you using 4 different processes to do work like this?

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Division of
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Johnson City, New York

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Hughes Owens Co., Ltd., Montreal

Universal Milling Machines

CINCINNATI MILLING MACHINE CO., Cincinnati 9, Ohio. Catalogue M-1429-1, describing the details of design of the new Cincinnati No. 2MI milling machines made in universal and plain types. 38

Bench-Size Hydraulic Presses

DENISON ENGINEERING CO., 1152 Dublin Road, Columbus 16, Ohio. Comprehensive booklet on the Denison bench-size Multipress and its manifold uses. 39

Threading and Tapping Tool

THREADMILLER CORPORATION, West Orange, N. J. Leaflet descriptive of the new Grip-Slide threading and tapping tool designed to speed up threading operations on lathes. 40

Induction Heating

WESTINGHOUSE ELECTRIC CORPORATION, Industrial Electronics Division, Baltimore 3, Md. Bulletin entitled "Induction and Dielectric Heating Applications and Equipment." 41

Impact Testing Machines

BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa. Bulletin giving specifications on the improved Sonntag universal impact testing machine for metals. 42

Control Valves

H. BELFIELD CO., Broad St. at Hamilton, Philadelphia, Pa. Bulletin 501, describing the new Belfield pilot piston control valve, a small wide range diaphragm motor control type. 43

Machining Ampco Metal

AMPCO METAL, INC., Milwaukee 4, Wis. Bulletin 66, giving information on the machining of Ampco metal and aluminum-bronze alloys based on actual experience of the company in machining these metals. 44

Tube Cut-Off Machine

ETNA MACHINE CO., 3400 Maplewood Ave., Toledo 10, Ohio. Catalogue describing in detail the features of the new Etna hydraulic tube cut-off machine. 45

Die-Less Duplicating

O'NEIL-IRWIN MFG. CO., 322 Eighth Ave., S., Minneapolis 15, Minn. Catalogue 46-10, descriptive of the Die-Acro system of die-less duplicating; illustrated by many examples. 46

Plastics

DOW CHEMICAL CO., Midland, Mich. Booklet entitled "Plastics Primer," containing information about the properties, fabrication, and uses of Dow plastics. 47

Hydraulic Presses

WROBLE ENGINEERING CO., 1067 Davis Terrace, Schenectady 3, N. Y. Bulletin on hydraulic presses for punching, forming, pressing, drawing, forging, and testing. 48

Toolmaker's Microscope

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago 14, Ill. Bulletin 155-64, describing a newly developed toolmaker's microscope. 49

Injection Molding Machines

WATSON-STILLMAN CO., Roselle, N. J. Bulletin 620-D, containing complete data on the construction and design features of the Watson-Stillman new horizontal injection molding machines. 50

Flexible Couplings

AMERICAN FLEXIBLE COUPLING CO., Erie, Pa. Catalogue 461, on this company's line of flexible couplings, giving installation and operating instructions and engineering data.....51

Abrasive Belt Grinders

HAMMOND MACHINERY BUILDERS, INC., 1600 Douglas Ave., Kalamazoo 54, Mich. Bulletin 310, announcing three new Hammond abrasive belt grinders. 52

Maintenance of Electronic Equipment

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh 30, Pa. Booklet entitled "Maintenance of Industrial Electronic Equipment." 53

Arc-Welding Machines

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Catalogue GEH-1334, containing instructions and parts list covering the G-E line of direct-current arc welders. 54

Cleaning Metal Parts

OPTIMUS EQUIPMENT CO., 159 Church St., Matawan, N. J. Bulletin 6E1, descriptive of equipment for washing, rinsing, pickling, and drying metal parts. 55

To Obtain Copies of New Trade Literature

listed on pages 228-234 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

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[SEE OTHER SIDE]

Threading Machines

THE GEOMETRIC TOOL CO., New Haven 15, Conn. Bulletin TM-2, on the company's No. 16 precision threading machine. 56

Tool Steel Data

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York 17, N. Y. Booklet entitled "Tool Steel for the Non-Metallurgist." 57

Ductility Testing Machine

STEEL CITY TESTING LABORATORY, 8843 Livernois St., Detroit 4, Mich. Bulletin on Model PA "Superior" ductility testing machines. 58

Electroplating Conveyors

HANSON-VAN WINKLE-MUNNING Co., Matawan, N. J. Bulletin FA-102, on full-automatic electroplating conveyors. 59

Protective Coatings

PRUFCOAT LABORATORIES, INC., 63 Main St., Cambridge 42, Mass. Bulletin on a new protective coating called "Prufcoat." 60

Air Cylinders

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago 22, Ill. Catalogue 234, on air cylinders for power and control purposes. 61

Diamond Compound

ENGIS EQUIPMENT CO., 431 S. Dearborn St., Chicago 5, Ill. Folder on "Hyprez" diamond compound for fine grinding, lapping, and polishing. ..62

Pneumatic Tools

ARO EQUIPMENT CORPORATION, Bryan, Ohio. Catalogue 46, containing forty pages describing the line of Aro pneumatic tools. 63

Diamond Wheels

DIAMONDS & TOOLS INC., 19345 John R, Detroit 3, Mich. Catalogue containing data on diamond wheels, including suggestions for using.....64

Conveyor Idlers

CHAIN BELT CO., 1600 W. Bruce St., Milwaukee 4, Wis. Bulletin 463, covering the line of Rex belt conveyor idlers. 65

Precision Gage-Blocks

FORD MOTOR CO., JOHANSSON DIVISION, Dearborn, Mich. Folder on Johansson gage-blocks and accessories. 66

Cutting Fluids

D. A. STUART OIL CO., LTD., 2739 S. Troy St., Chicago 23, Ill. Technical bulletin 4 on cutting fluids.....67

Tube Fabrication

MURRAY TUBE WORKS, Elizabeth, N. J. Folder entitled "Modern Tube Fabrication for Industry." 68

Grid Bearings

P. R. MALLORY & CO., INC., Indianapolis 6, Ind. Technical bulletin descriptive of a new grid bearing designed to combine good surface properties and embeddability with high strength and fatigue resistance.....69

Nitriding Stainless Steels

In answering a question relating to the nitriding of stainless steels, the editor of *Nickel Steel Topics*, published by the International Nickel Co., 67 Wall St., New York City, states that a type of stainless steel known as 304, containing 19 per cent chromium and 9 per cent nickel, has been nitrided with good results. The procedure includes a forty-hour treatment at from 975 to 1025 degrees F. in ammonia gas. This treatment produces a case approximately 0.007 inch deep, with a hardness of from 65 to 73 Rockwell C.

The nitriding treatment increases the dimensions of the part from 0.0003 to 0.0008 inch, which must be taken into consideration when parts require accurate fitting with other parts. The surface corrosion resistance of stainless steel is somewhat reduced by nitriding, but is superior to that of standard Nitralloy.

* * *

The building of automobiles is just a small part of the great industrial enterprises that have grown up as a result of the automobile business. It is estimated that 90 per cent of the oil industry, 80 per cent of the rubber industry, 75 per cent of the plate glass industry, and 18 per cent of the steel business depend on the automobile as an outlet for their products. Obviously, the road-building industry, including the machinery and supplies used in road building, is almost entirely due to the requirements of the automobile.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 201-224 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in August, 1946, MACHINERY.

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To obtain additional information about any of the materials described on pages 198-200, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in August, 1946, MACHINERY.

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Tapping AND *Threading* S.A.E. 4140 STEEL

SUNICUT . . .

Makes possible fast production of fine threads

Here's an operation where Sunicut helped produce fine-finish threads on tough steel at relatively high speed

Type of Machine: New Britain Gridley automatic screw machine, 2" capacity, No. 61, six spindles.

Metal: S.A.E. 4140 bar stock.
Operation: Forming, drilling, tapping, and threading.
Speed. 85 SFPM

SUNICUT is a free-flowing, transparent, correctly balanced sulphur, lard, and mineral oil combination. It has been "Job-Proved" in hundreds of shops. For additional proof of what Sunicut can do for you, test it in your own shop under your own operating conditions!

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INDUSTRIAL PRODUCTS

News of the Industry

California

HYDRO-BORER CO., a division of SOUTHWESTERN DEVELOPMENT CO., announces that its plant and executive offices have been moved from 1740 W. 59th St., Los Angeles, Calif., to 214 W. Orange Grove, Burbank, Calif. The company will continue to manufacture a complete line of hydraulic boring machines for aircraft and automotive applications.

CARL W. COSLOW has been made vice-president in charge of manufacturing of the Plomb Tool Co., 2209 Santa Fé Ave., Los Angeles, Calif. Mr. Coslow was formerly works manager.

THOMAS G. FRANZREB has joined the Technical Service Division staff of Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif., manufacturer of industrial cleaning compounds.

Delaware

WALTER H. LIPPINCOTT has been elected president and treasurer of the Lobdell Co., Wilmington, Del., manufacturer of forging hammers, slotters, and papermaking machinery. Mr. Lippincott made a distinguished record in the war, serving as chief of staff of the 26th Infantry Division (Third Army). He was awarded the Legion of Merit, Bronze Star Medal, Commendation Ribbon, Croix de Guerre with Star (France) and Order of Red Star (Russia). He was discharged from the service in December, 1945, as a colonel in the reserve corps.

Walter H. Lippincott, New President and Treasurer of the Lobdell Co.

Georgia

C. C. SMITH has been appointed special headquarters electronics sales representative for the Westinghouse Electric Corporation, assigned to the southeastern district with offices in Atlanta, Ga. Mr. Smith will be available for consultation on high-frequency heating and other electronics equipment applications in his territory.

EUGENE W. O'BRIEN, vice-president of the W. R. C. Smith Publishing Co., Atlanta, Ga., has been nominated as next president of the American Society of Mechanical Engineers.

Illinois and Indiana

JOHN E. ANDRESS, who for nearly forty years has been connected with the Barnes Drill Co., Rockford, Ill., has retired from active responsibility in the management, but will continue as chairman of the board of directors. He and the late B. Frank Barnes organized the Barnes Drill Co. in July, 1907, and since then he has served the company as secretary, treasurer, vice-president, president, and chairman of the board. Previous to the formation of the Barnes Drill Co., Mr. Andress was secretary-treasurer of the B. F. Barnes Co. for five years, and before that he was associated for several years with the Norton Emery Wheel Co. at its Chicago office.

ERNEST L. HARTIG, vice-president and treasurer of Joseph T. Ryerson & Son, Inc., Chicago, Ill., has retired after forty-five years of service with the company. Starting in the bookkeeping department, he became successively cashier, secretary and assistant treasurer, vice-president and secretary, and finally vice-president and treasurer, which position he has held since 1933. MERLE A. MILLER will succeed him as treasurer.

HOLUB INDUSTRIES, INC., 413 DeKalb Ave., Sycamore, Ill., is a new concern organized by BERT E. HOLUB to manufacture electrical and mechanical products. Mr. Holub was formerly general sales manager of Ideal Industries, with which organization he served for twenty-four years. GORDON W. WETZEL is sales manager of the new concern.

BAKELITE CORPORATION, 300 Madison Ave., New York 17, N. Y., announces the acquisition of the former Inland Rubber Co.'s plant site northwest of Ottawa, Ill. The company plans to erect a new manufacturing plant for producing Vinylite plastics for consumer and industrial goods.

LOVEJOY FLEXIBLE COUPLING CO., 5001-5009 W. Lake St., Chicago 44, Ill., has acquired in its entirety the mechanical power transmission department of IDEAL INDUSTRIES, Sycamore, Ill. This includes both manufacturing and sales rights.

MICHIGAN BROACH CO., Detroit, Mich., maker of broaches, fixtures, and gages, has appointed ED. G. DORAN sales representative for the company in Chicago and northern Illinois.

JUSTIN J. WETZLER has been appointed director of engineering, and J. HARVEY CHANDLER chief engineer of Barnes & Reinecke, designers and engineers, 230 E. Ohio St., Chicago, Ill.

STRONGHOLD SCREW PRODUCTS, INC., 216-222 W. Hubbard St., Chicago 10, Ill., is the new name of the organization formerly known as the MANUFACTURERS SCREW PRODUCTS.

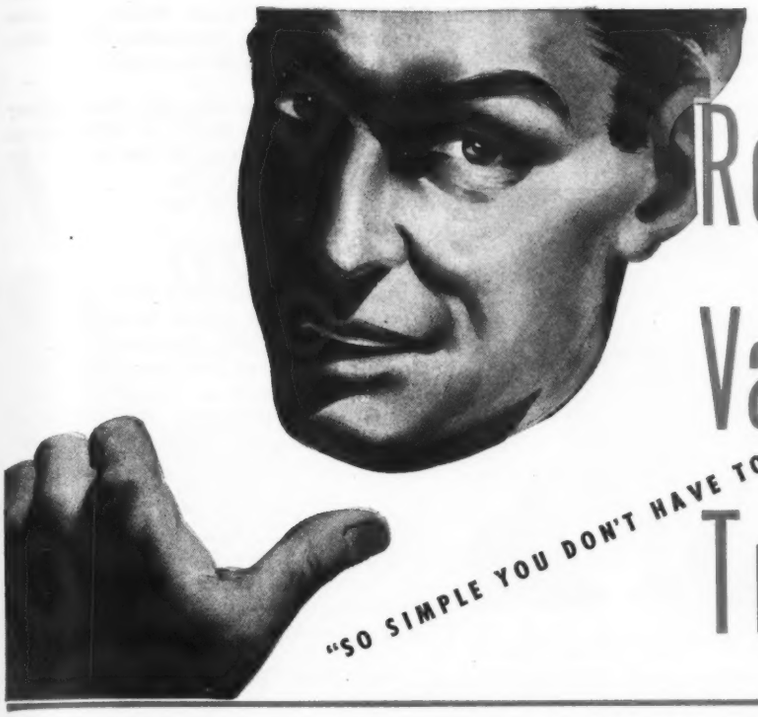
GENERAL MOTORS CORPORATION, ALLISON DIVISION, Indianapolis 6, Ind., announces that it has set up a new unit devoted exclusively to the development and production of bearings. B. L. CRUZAN has been named manager of the new unit, and E. G. DAVIS will have direct charge of production and development.

KENNETH H. BARNES has been appointed chief engineer of the American Foundry Equipment Co., Mishawaka, Ind. CHALMER R. CLINE has been made engineering assistant to the president, and SHERRILL S. DEPUTY new assistant sales manager.

Massachusetts and Connecticut

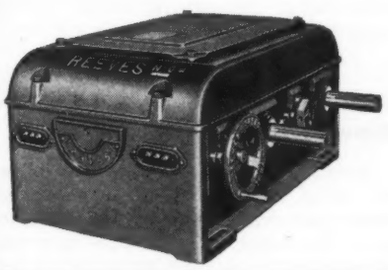
R. W. PRICE, who has represented the Norton Co., Worcester, Mass., in the Connecticut area for many years, has been appointed district manager of that area by the Abrasive Division of the company. O. A. NIERENDORF, who has also been connected with the company for many years in that territory, has been given an indefinite leave of absence because of ill health. C. B. PRICE, JR., who has recently returned from service in the Navy, has been appointed abrasive engineer, and will take over a large part of Mr. R. W. Price's former territory in the northern half of Connecticut.

WILLIAM E. RUDEL, formerly Captain of Artillery, A.U.S., has been appointed New England manager for Rudel Machinery Co., Inc., 100 E. 42nd St., New York 17, N. Y. He will be located at the Statler Bldg., Boston, Mass. J. B. RILEY, formerly Lieutenant S.G., U.S.N.R., has also joined the company to handle the larger accounts in the metropolitan Boston district, and will make his headquarters at the same address.

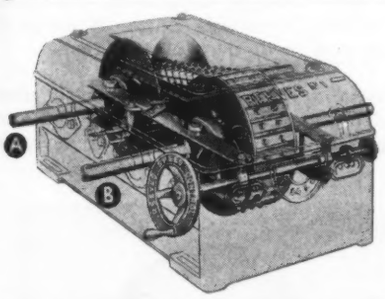


Reeves Variable Speed Transmission

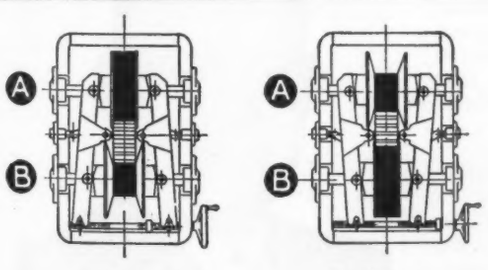
"SO SIMPLE YOU DON'T HAVE TO BE AN EXPERT TO MAINTAIN 'EM"



What it is— Modern, compact, rugged unit which provides accurate, stepless, variable speed control for industrial machines. May be mounted in any position—on floor, ceiling, wall, platform or on driven machine. Available in sizes from fractional to 87 hp. and in a wide range of speed variation from 2:1 to 16:1 inclusive. Horizontal and vertical types in open and enclosed designs. Easy to lubricate through force-feed fittings. Speed shifting may be accomplished by manual (handwheel), electric remote (push button) or completely automatic controls. Universally adjustable motor bases for individual motor drive.



What it does— The degree of speed regulation provided by the REEVES Transmission is infinite between predetermined limits. Any change of speed—even to smallest fraction of an rpm—is instantly available, and, once secured, may be accurately maintained as long as required. Entire speed range is covered smoothly without steps or jumps and while driven machine is in operation. Speeds may be changed without interrupting production, as required by different materials, shapes, sizes, operator skills, changing diameters in winding and cutting processes, etc. Results: production is faster and of uniformly higher quality.



At Maximum At Minimum

How it works— Design is based on simple, time-tested principle of a V-belt driving between two pairs of adjustable cone-shaped discs, mounted on parallel shafts. One shaft (A) receives power at constant speed from motor, lineshaft, etc. The other shaft (B) connected to driven machine transmits power at infinitely adjustable speeds above and below speed of constant speed shaft as V-belt assumes different diameters of contact against each set of discs. Note positions of discs and speed changing levers at minimum speed setting and how these positions are reversed at maximum. Number of in-between speeds is infinite.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Standardly Furnished on Many Leading Makes of Machines

Accurate Variable
REEVES Speed Control
Gives the Right Speed for Every Job!

Send at once for comprehensive 96-page Catalog M-450.

WALTER C. FOOTE has been appointed Norbide engineer by the Norton Co., Worcester, Mass., for the states of Michigan and Ohio, succeeding F. C. KNOWLES, who has resigned because of poor health.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., recently presented seventy-six of its employes having service records of thirty-five through forty-nine years with engraved gold wrist watches. The presentation was made by Franklin Farrel, Jr., chairman of the finance committee at the annual dinner of "Old Timers." A. Austin Cheney, chairman of the board of directors, acted as toastmaster. The guest of honor was Commodore Lisle F. Small, U. S. Navy, Commandant, Norfolk Navy Yard, Portsmouth, Va., who addressed the gathering and complimented the organization on its "unexcelled cooperation" with the U. S. Navy during the years of war production.

HADLEY, RYDER & PEDERSON, Hartford, Conn., design consultants, is a concern recently organized by DONALD L. HADLEY, formerly design consultant for the Westinghouse Electric Corporation; CARLETON B. RYDER, previously coordinator of apparatus design with the General Electric Co.; and NICHOLAS F. PEDERSON, formerly technical supervisor with General Electric.

Michigan

CLIFFORD M. MANZER has been appointed chief engineer of the Progressive Welder Co., Detroit, Mich. Mr. Manzer was connected with the General Electric Co. for twenty-two years, the last eleven of which he had charge of research, development, and manufacturing processes connected with resistance welding at the Lynn, Mass., plant. WALTER L. JEWETT, previously chief engineer, has been appointed manager of development engineering for the Progressive Welder Co. He has been connected with the company for the last ten years.

Clifford M. Manzer, Newly Appointed Chief Engineer, Progressive Welder Co.

MARSHALL M. SMITH has been elected vice-president and a director of the E. W. Bliss Co., manufacturer of presses and can machinery. Mr. Smith has been connected with the company since February, 1945, as director of foreign operations. Prior to his association with the Bliss organization, he was connected for nineteen years with the Worthington Pump Co. His office will be in the company's newly acquired executive headquarters at 450 Amsterdam St., Detroit, Mich.

Marshall M. Smith, Newly Elected Vice-president and Director of the E. W. Bliss Co.

DETREX CORPORATION, manufacturer of metal cleaning equipment and chemicals, announces that it is now occupying a new plant at 14331 Woodrow Wilson, Detroit 32, Mich., which will considerably increase the production facilities of the company. The corporation also announces the opening of a new office and warehouse at 435 Ionia Ave., S.W., Grand Rapids 2, Mich.

ROLAND S. HIGGINS has joined Hydropress, Inc., New York City, builder of heavy hydraulic machinery and rolling mills, as sales representative and head of the organization's Detroit branch office. His headquarters will be at 1608 Industrial Bank Building, 1400 Washington Blvd., Detroit 26, Mich.

R. W. MASON, JR., formerly associated with the Lithium Co., Newark, N. J., has joined the Development and Research Division of the International Nickel Co., Inc. He will make his headquarters at the Detroit Technical Section of the division in the General Motors Bldg., Detroit, Mich.

J. D. HAMACHER has been made plant engineer of the Detrex Corporation, Detroit 32, Mich. He joined the Detrex organization early in 1944, and has been employed as a design engineer in the Oil-extraction Division.

ROBERT L. TYLER has been elected president of the Tyler Fixture Corporation, Niles, Mich., succeeding his brother Jerry Tyler, who died recently.

KOPPY TOOL & DIE CO., 3402 Ellery Ave., Detroit 7, Mich., is successor to KOPPY-DE KORSE TOOL & DIE CO.

New Jersey

GEORGE A. LENNOX has been appointed vice-president in charge of sales of the Driver-Harris Co., Harrison, N. J. JOSEPH B. SHELBY has been made assistant vice-president in the same department. Mr. Lennox has been connected with the company since 1907, and Mr. Shelby since 1919.

R. M. HOLLINGSHEAD CORPORATION, Camden, N. J., has organized a new Coatings Division for the development of protective coatings and industrial packaging materials. R. P. HENDREN is director of sales of the division.

NEW YORK BELTING & PACKING CO., Passaic, N. J., manufacturer of belting and other industrial rubber products, is celebrating its one-hundredth anniversary this year.

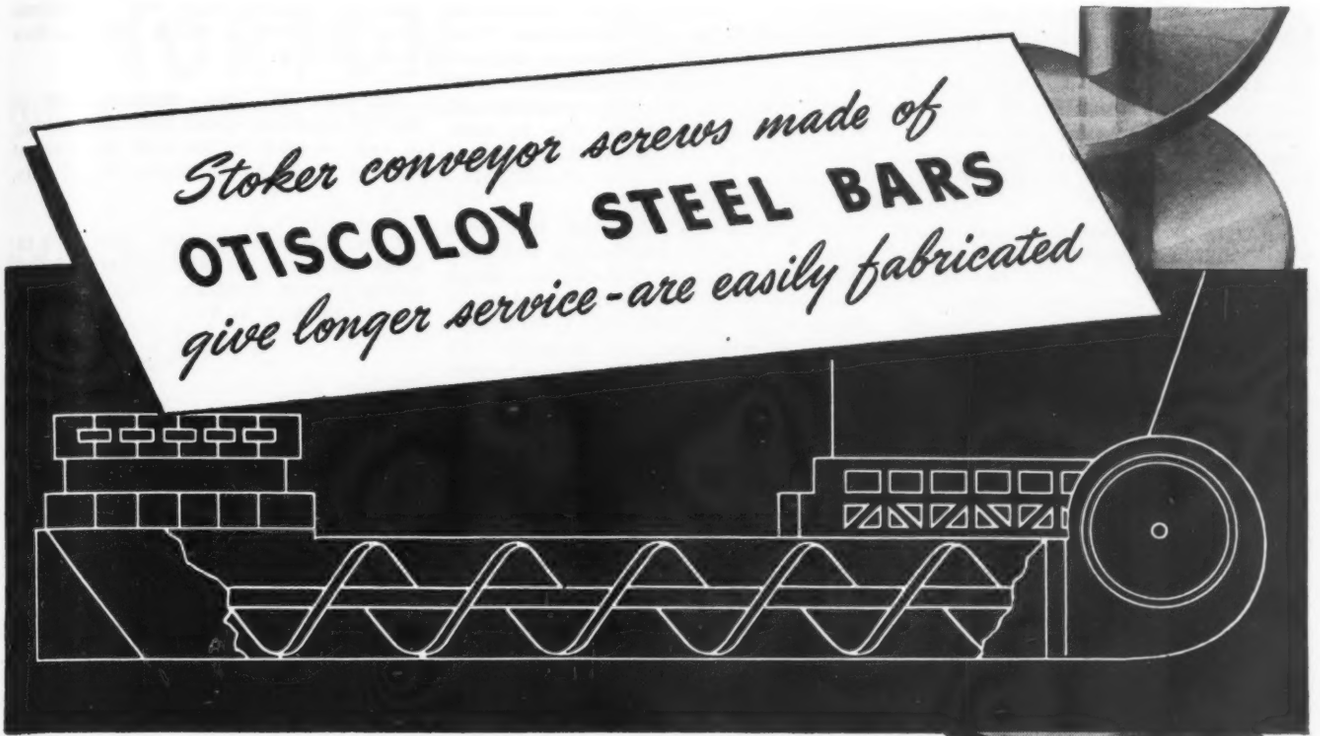
New York

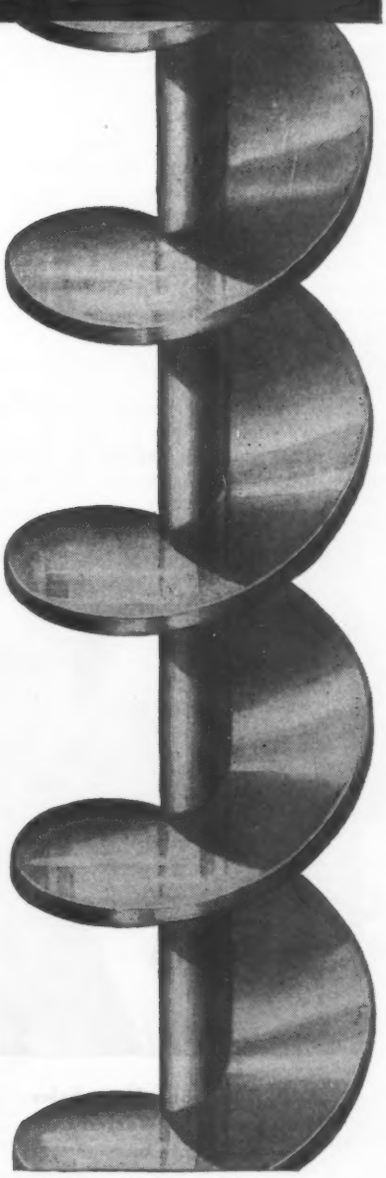
PETER A. FRASSE & CO., INC., 17 Grand St., New York 13, N. Y., has opened a new steel warehouse at 157 Richmond Ave., Syracuse, N. Y. The new warehouse will serve as a distributing point for steel used in mechanical industries in central New York State. WILLIAM E. KARNUTH is district sales manager.

VERNON H. VAN DIVER, formerly associated with the Union Carbide and Carbon Corporation, in charge of advertis-

Vernon H. Van Diver, Head of a New Merchandising and Advertising Council Business

Stoker conveyor screws made of
OTISCOLOY STEEL BARS
give longer service - are easily fabricated





The inherent physical qualities of Otiscoloy steel deliver longer service on stoker conveyor screws. Otiscoloy provides greater resistance to abrasion and corrosion, two principal deterrents to maximum stoker life.

Otiscoloy possesses qualities necessary for easy fabrication. A spiral screw made of an Otiscoloy flat bar is readily welded to an Otiscoloy core rod.

Otiscoloy is suited to many other applications which require strength with light weight as well as resistance to abrasion and corrosion.

For longer service life and speedier manufacture specify Otiscoloy. Write for Otiscoloy booklet.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PENNSYLVANIA

ing for the parent company and a number of the divisions, has opened his own business as merchandising and advertising counselor, with offices in the McGraw-Hill Building, 330 W. 42nd St., New York 18, N. Y. Mr. Van Diver will also head the Brad-Vern Co. Advertising Agency at Garden City, N. Y.

CHARLES A. SIMMONS, SR., president of the Simmons Machine Tool Corporation, Albany, N. Y., left the United States in June for a trip to Europe to survey the machine tool requirements of leading industries in several countries, including France, Belgium, Switzerland, and Sweden. He planned to be gone for a period of six weeks to two months. During the war, Mr. Simmons served as chief of the Available Tools Division of the Office of Production Management, then of the War Production Board, and later of the United States Navy Bureau of Ships.

FRANK M. HAWLEY has been made president of the Morse Chain Co., Ithaca, N. Y., a subsidiary of the Borg-Warner Corporation. Mr. Hawley was formerly vice-president and general manager, in which latter capacity he will continue. He has been with the Morse organization for thirty years in various capacities. RAY P. JOHNSON has been made first vice-president and assistant general manager of the company. Mr. Johnson has been with the Borg-Warner organization since 1930, and has served as a director since 1936.

WALTER C. KERRIGAN has been appointed manager of the nickel sales department of the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., succeeding the late Rudolph L. Suhl.

AIRCO EXPORT CORPORATION, 33 W. 42nd St., New York 18, N. Y., has opened a permanent products exhibit at its main offices, designed primarily to demonstrate the products of the corporation to buyers and representatives from abroad. The exhibit includes displays of welding and cutting equipment made by Air Reduction Sales Corporation and Wilson Welder & Metals Co. In addition, there are alloy steel, chemical, and medical equipment groups of exhibits.

DR. ALEXANDER W. LUCE has been made chairman of curriculum and head of the Department of Mechanical Engineering of the Pratt Institute School of Engineering, Brooklyn, N. Y. Professor Luce has had extensive academic and industrial experience. He was a former faculty member at Lehigh University and at the Universities of New Mexico and Connecticut. Of recent years, he has been connected with the Fellows Gear Shaper Co., Springfield, Vt.

PAUL H. WINTERS has been appointed chief engineer of the New York office at 1775 Broadway, New York 19, N. Y., of the La Salle Engineering Co., whose headquarters are in Chicago, Ill. Previous to his present connection, Mr. Winters was associated for four years with the Heald Machine Co., Worcester, Mass.

DE LAVAL SEPARATOR CO., 165 Broadway, New York 6, N. Y., announces the opening of two new offices—one in Minneapolis at 7212 Oak Grove Blvd., and one in Kansas City, at 4746 Roanoke Parkway. R. E. THRUSH will be in charge of the Minneapolis office, and P. W. PERRY of the Kansas City office.

EDWARD S. CHRISTIANSEN CO., is establishing a showroom at 30 Rockefeller Plaza, New York 20, N. Y., where it will exhibit all forms of aluminum and magnesium raw materials, as well as semi- and fully-fabricated assemblies and finished consumer goods.

METALLIZING CO. OF AMERICA, 1330 W. Congress St., Chicago 7, Ill., announces that its eastern office and warehouse have been moved to 431 E. 75th St., New York 21, N. Y.

SEAMLEX CO., INC., manufacturer of flexible seamless metal hose and tubing, is now located in its new building at Queens Plaza, North, Long Island City, N. Y.

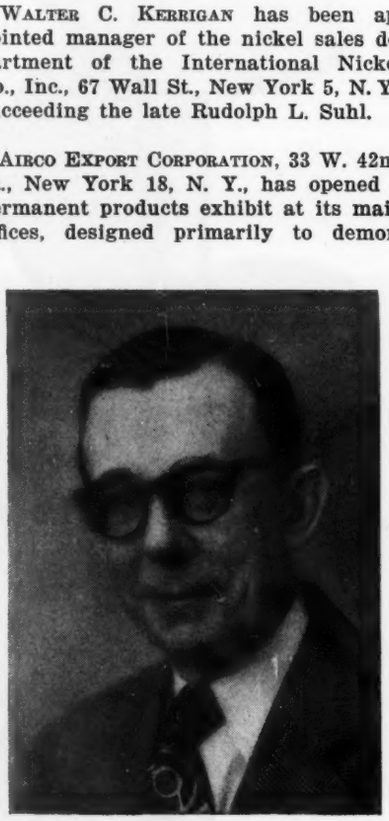
CARL E. BOLTE has been appointed executive secretary of the National Lubricating Grease Institute, with headquarters in Buffalo, N. Y.

Ohio

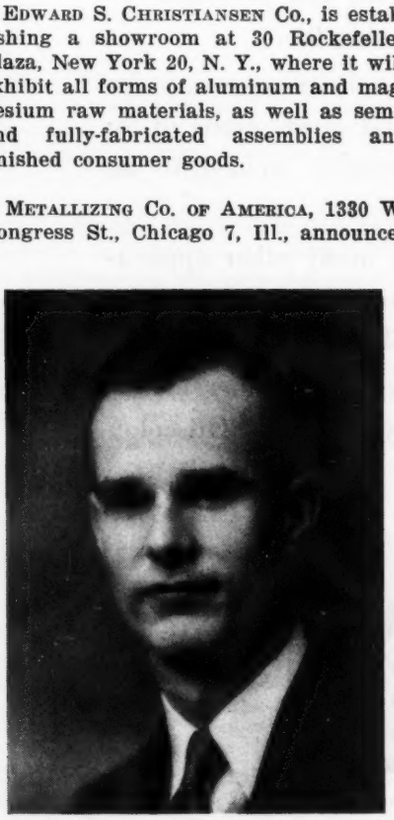
LUKENS STEEL CO. and its subsidiary BY-PRODUCTS STEEL CORPORATION have opened a branch sales office at 1201 Citizens Bldg., Cleveland 14, Ohio, which will handle the territory formerly served by J. F. CORLETT & CO. ROBERT H. MCCRACKEN, who has been district manager of sales of the Lukens Boston office, will be manager of the new office. J. F. COBURN, previously a member of the firm of J. F. Corlett & Co., will be associated with the Cleveland office, and W. B. HARRIS, formerly manager of the Corlett Cincinnati office, will be Cincinnati representative of Lukens and By-Products, with office at 1432 Union Trust Bldg., Cincinnati 2, Ohio.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the following additions to its staff of field welding engineers: GORDON APPLEBY, Philadelphia, Pa., TERRIL S. HOFFMAN, St. Louis, Mo., E. JAMES LANGHURST, Chicago, Ill.; and GARRET S. PARSONS, Los Angeles, Calif.

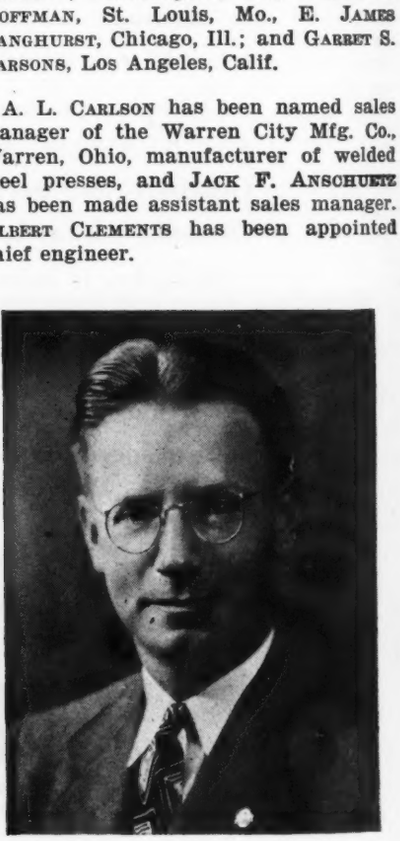
A. L. CARLSON has been named sales manager of the Warren City Mfg. Co., Warren, Ohio, manufacturer of welded steel presses, and JACK F. ANSCHUETZ has been made assistant sales manager. ALBERT CLEMENTS has been appointed chief engineer.



A. L. Carlson, New Sales Manager of the Warren City Mfg. Co.



Jack F. Anschuetz, Assistant Sales Manager of the Warren City Mfg. Co.

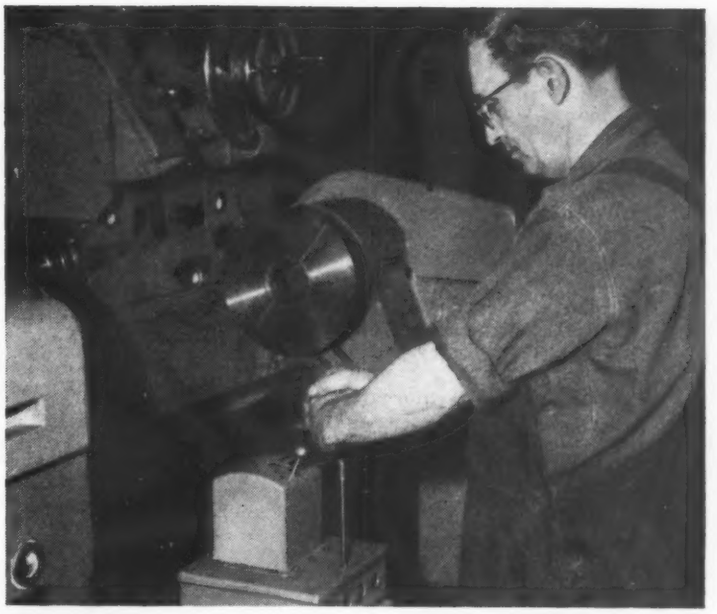


Albert Clements, Recently Appointed Chief Engineer, Warren City Mfg. Co.

NORTON

TELLS INDEPENDENT INVESTIGATOR

"No more burrs, breaks, or skids when we set 'em-up solid!"



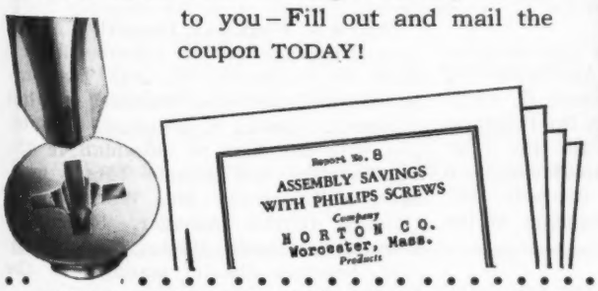
"PHILLIPS SCREWS ended our former troubles with slotted screws", Norton officials told the investigator from James O. Peck Co., industrial research authorities. His study of assembly methods at Norton Co., world renowned manufacturer of precision grinding machines, is one of a series being made in representative plants using Phillips Screws.

"BURRS CAN'T BE TOLERATED in a good machine tool," said a Norton engineer. "First, they reflect on workmanship and quality. Second, they'd threaten injuries to operators by snagging waste used in wiping. When heads burred or broke, they had to be removed and replaced, wasting time.

"DRIVER SKIDS WERE ALSO FREQUENT with slotted screws, because of the extra pressure, causing injuries to hands banged against adjacent parts.

"WITH PHILLIPS SCREWS, we've ended burring, breaking, and driver skids. The driver stays in the recess, with any pressure. Starting in any position is easier, quicker – driving is faster."

GET THE COMPLETE REPORT. With other reports now ready on leading manufacturers' savings with Phillips Screws, and more to come – covering products of metal, plastics, wood – it affords a practical manual of modern assembly methods. Get these inside facts – worth good money – FREE to you – Fill out and mail the coupon TODAY!



PHILLIPS SCREW MFRS., c/o Horton-Noyes 8
2300 Industrial Trust Bldg., Providence, R. I.
Please put me on the list to receive all reports on Assembly Savings with Phillips Screws

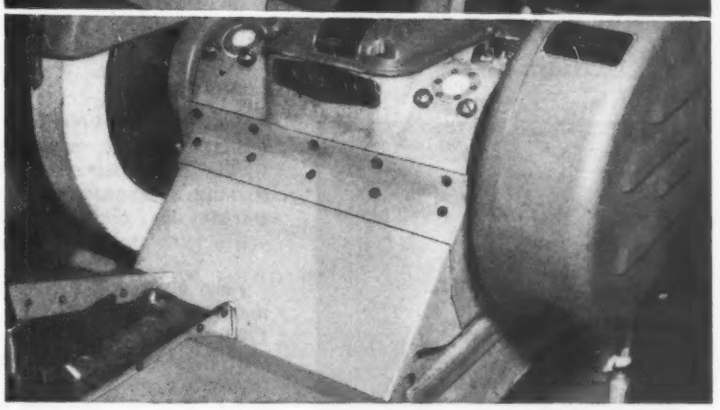
Name .....

Company .....

Address .....

.....

"SCREW TIGHTNESS IS A 'MUST' in our machines, to eliminate vibration. We have to set-'em-up to the limit, which means a heavy torque load on the screwhead. With slotted screws this meant burrs, breakage, or driver skids, but the Phillips head can take it."



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.

26 SOURCES

Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg.Co.
New England Screw Co.
Parker-Kalon Corporation

Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Wolverine Bolt Company

LESTER ENGINEERING Co. announces that the Tool and Die Division of the company has been reorganized under the name of LESTER-AETNA DIE Co., and has been moved from Cleveland to Warren, Ohio. The new concern will offer complete engineering and manufacturing service for both die-casting dies and plastic molds. It is owned jointly by the Lester Engineering Co. of Cleveland, and the Aetna-Standard Engineering Co. of Warren, Ohio. The officers are NATHAN LESTER, president; H. GERALD COFFEY and D. WHITE, vice-presidents; LLOYD L. DALBEY, secretary-treasurer.

A. M. MACCUTCHEON, senior vice-president of the Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio, retired on July 1 in order to devote his full time to certain projects of his own. He will still continue to serve the company as a consultant. Mr. MacCutcheon joined the company in 1914 to design a new line of adjustable-speed, direct-current motors. In 1917, he was made chief engineer, and in 1923 became engineering vice-president.

N. H. CRITTON, formerly district manager at Newark, N. J., for the Monarch Machine Tool Co., Sidney, Ohio, has been made eastern sales manager, with headquarters in New York. In his new position Mr. Critton will also have supervision of an export sales staff now being organized. F. J. GRIFFIS, of the Monarch eastern sales staff, becomes district manager in Newark.

MRS. FLORENCE M. SAYLE was recently elected president of the Cleveland Punch & Shear Works Co., Cleveland, Ohio, and has assumed active management of the company, succeeding her late husband, W. Chichester Sayle, who died last fall. Previous to her connection with the Cleveland Punch & Shear Works Co., Mrs. Sayle served for five years in an executive position with the General Electric Co., where she acquired a knowledge of the manufacturing and marketing of industrial products.

Moffett Studio

Mrs. Florence M. Sayle, New President of the Cleveland Punch & Shear Works Co.

NEIL A. BENSON has been made plant manager of the plant at Orrville, Ohio, recently acquired by the Hagan Corporation, Pittsburgh, Pa. from the Will-Burt Co. Mr. Benson is already engaged in the rebuilding and expanding of the plant. He has a long record of engineering and manufacturing experience.

SHEFFIELD CORPORATION, Dayton, Ohio, has secured the exclusive sales rights for the calibrated optical flats and "Interference Viewers" made by the OPTRON LABORATORY.

HARRY W. BARKLEY has been elected president of the National Tool Co., Cleveland, Ohio. Mr. Barkley was formerly executive vice-president and general manager of the company. He succeeds LEWIS F. JUBENVILLE, who has been serving temporarily as president. Mr. Barkley was connected for twenty-seven years with the Ford Motor Co.

Harry W. Barkley, Newly Elected President of the National Tool Co.

FRED E. AMON, formerly general sales manager of the Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio, will devote his full time in the future to managing aircraft sales for the company. DAN W. HOLMES, previously with the Weatherhead Co., succeeds Mr. Amon as general sales manager of the Parker Appliance Co.

H. K. TRYON, who has been associated with the Lukens Steel Co., Coatesville, Pa., since 1937, has been appointed a member of the sales staff of the newly opened Cleveland office of the company and its subsidiary, By-Products Steel Corporation. Mr. Tryon will make his headquarters at the company's new office, located at 1201 Citizens Bldg., Cleveland 14, Ohio.

Alfons Alven, Recently Elected President of the Bearings Co. of America

Pennsylvania

ALFONS ALVEN has been elected president of the Bearings Co. of America, Lancaster, Pa., succeeding HENRY W. JACKSON, who has resigned. Mr. Alven joined the organization in 1932 as district manager of the Chicago office. In 1946, he was elected a director. Prior to joining the company, he had had ten years' experience in ball bearing manufacture and sales. He is a graduate of Stevens Institute of Technology in mechanical engineering.

WILLIAM L. BATT, president of SKF Industries, Inc., Philadelphia, Pa., has been made an honorary companion of the Order of St. Michael and St. George by King George VI in recognition of his wartime work as a member of the Combined Production and Resources Board, composed of representatives of the United States, Canada, and Great Britain. In addition to serving on this international board, Mr. Batt also acted as vice-chairman of the U. S. War Production Board from 1940 to 1946.

JOSEPH E. WORKMAN, formerly Chicago district manager for the Latrobe Electric Steel Co., Latrobe, Pa., has been appointed assistant sales manager for that company. ROBERT F. FRAZURE, who began with the firm as salesman in the Toledo office and became Toledo manager, will succeed Mr. Workman as Chicago district manager. RALPH H. BAILEY, previously Dayton, Ohio, manager, becomes district manager of the Toledo office.

HERBERT G. AUSTIN, who has been assistant district manager of sales in the Boston office of Lukens Steel Co., Coatesville, Pa., and its subsidiaries, By-Products Steel Corporation and Lukenweld, Inc., has been promoted to the position of district manager of sales at Boston, succeeding ROBERT H. Mc-

Over One Million feet of precision threads with just six cutters!

Part: Large adaptor plug.
Material: SAE 1035.
Thread Diam.: 4" and 6⅜" on each piece.
No. of Threads: 8 and 10 respectively. (12 pitch)
Tolerance: ± 0.005 in. (on pitch diameter)
Quantity: 50,000 pieces.
Output: 15 parts per hr. per machine. (16 hrs/day)
Tools Required for Run: Only 6 "Detroit" thread milling cutters.
Average No. of Grinds: 18 per Cutter.
Stock Removed per Grind: .015 to .020 in.

Those are cold figures but to the tool engineer and production man they tell a real cost-saving story—the kind of performance needed today to keep costs down—the kind of performance "Detroit" thread milling cutters are giving day in and day out.

Those "Detroit" cutters were just as good as new even after 18 sharpenings apiece.

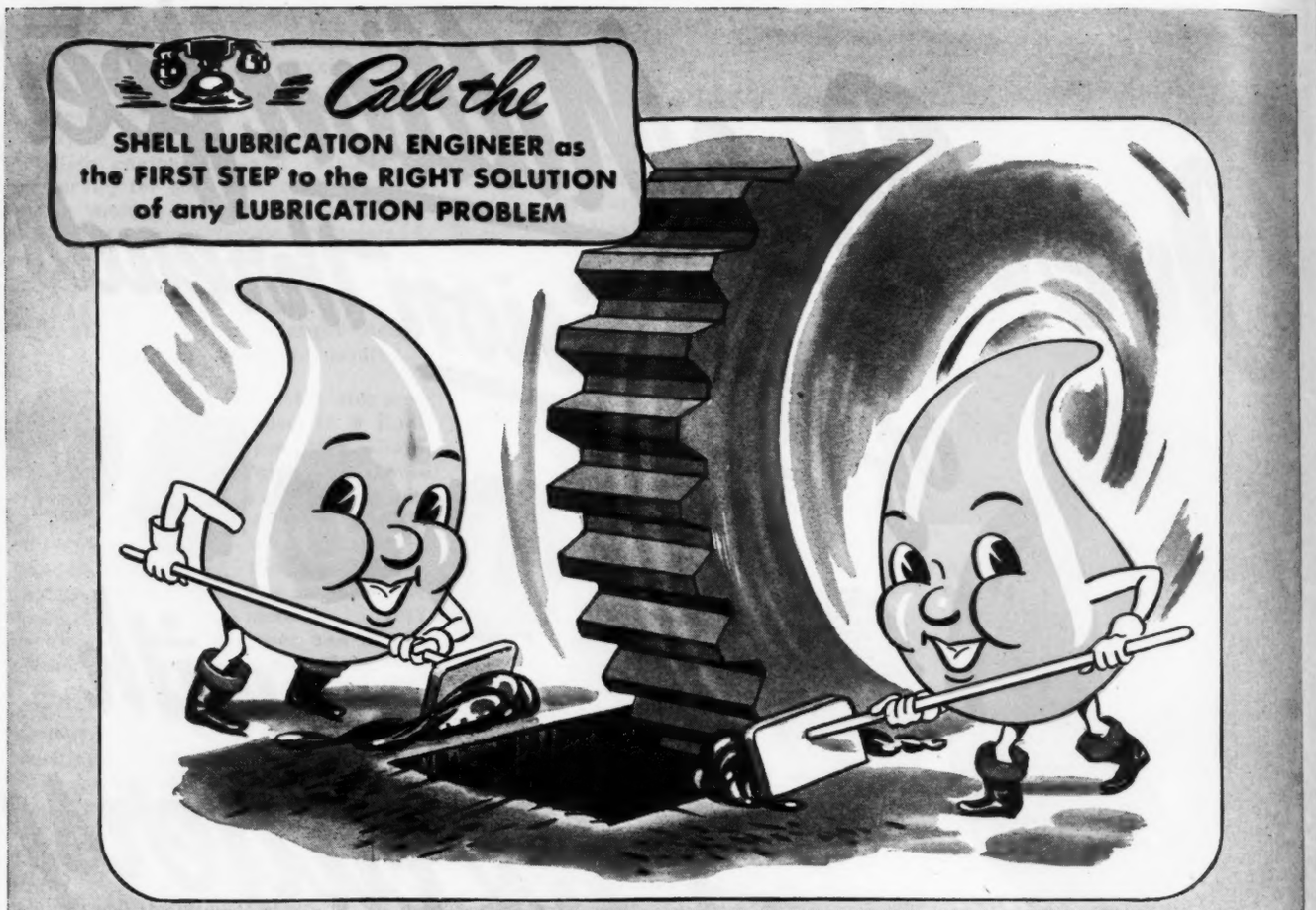
What's more, "Detroit" thread milling cutters are easy to order. Most widely used types and sizes are even carried in stock, ready for thread grinding to your specs.

Ask for Bulletin No. CB-45

• Ground Taps • Tap Reconditioners •

DETROIT TAP & TOOL CO.
8432 BUTLER AVE. • DETROIT 11, U.S.A.

• Thread Gages and Special Threading Tools, Machines and Checkers •



SHELL EXL GREASE OVERCOMES CHANNELING in Gear Case

PROBLEM: Electric hand-held tools designed for infrequent use were being operated continuously in a metal fabrication shop. After two days' service, gears ran hot and tools were noisy. "Channeling" of the grease was recognized as the cause of trouble, and, though a nuisance, a schedule of maintenance overhaul *every other day* had to be maintained.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem, he recommended a Shell EXL Grease. This grease has the consistency required for gear-case use, and also has a "slump" property by which it fills a channel cut by gears. Results were immediate. Gears ran cool, chatter ceased. Maintenance checks and re-greasing were extended to weekly intervals.

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. For informative literature about Industrial Greases, write Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York or 100 Bush Street, San Francisco 6, California.

SHELL INDUSTRIAL GREASES

SHELL

"TROUBLE SHOOTING" IN HYDRAULICALLY OPERATED SYSTEMS—1

A. Causes of General Operation Difficulties

1. Use of the wrong type of oil.
2. Insufficient fluid in the system.
3. Presence of air in the system.
4. Mechanical damage or structural failure.
5. Internal or external leakage.
6. Dirt, decomposed packing, water, rust, sludge, etc., in the system.
7. Improper adjustments.
8. Oil cooler plugged or dirty.

B. Failure of Pump to Deliver Flow

1. Low fluid level in reservoir.
2. Pressure and supply lines reversed or motor direction reversed.
3. Pump drive-shaft key sheared.
4. Intake valves plugged.
5. Air leak in suction line.
6. Pump shaft turning too slowly to prime itself.
7. Oil viscosity too heavy to pick up prime.

C. Loss of System Pressure

1. Pump not delivering oil for reasons under B.
2. Low fluid level in reservoir.
3. Excessive leakage—internal or external.
   a. Regulator stuck in the cutout position.
   b. Relief valves unseated by foreign particles.
   c. Leakage at poppets in selector valves.
   d. Pump failure.
   e. Leaky check valve in pressure regulator.
   f. Use of oil having wrong viscosity at operating temperature.
4. Pump not developing pressure.

MACHINERY'S Data Sheet No. 567, August, 1946

Compiled by J. C. Van Gundy
The Texas Co., New York

"TROUBLE SHOOTING" IN HYDRAULICALLY OPERATED SYSTEMS—2

D. Pump Chatter

This is caused by any condition which limits the flow of oil into the suction side of the pump. Possible causes are:

1. Plugged inlet screen.
2. Air leaking into suction side.
3. Sticking of vanes in vane type pumps.
4. Use of an oil having too high a viscosity (particularly true at low temperature).
5. Worn pump.
6. Relief valve chattering.
7. Coupling misalignment.
8. Pump running too fast.

E. Excessive Heating

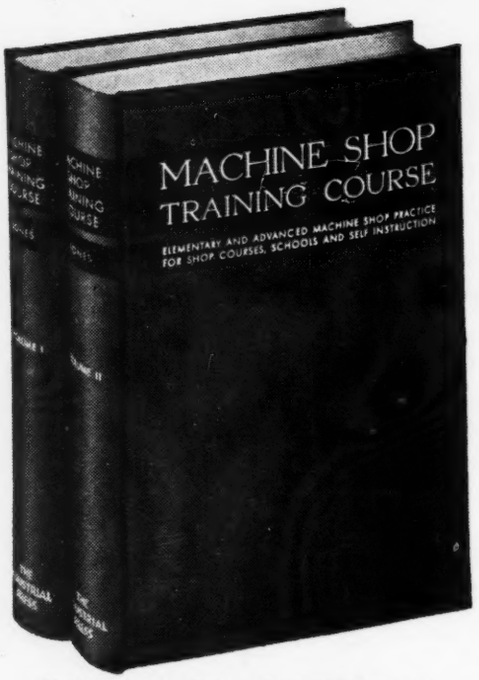
1. Pump discharging at a higher pressure than necessary due to excessive amount of oil dissipated through relief valve, or throttle valves, or by increased slippage in various parts.
2. Internal oil leakage due to wear.
3. Viscosity of oil too high.
4. Pumps assembled after overhaul may be assembled too tightly, thus reducing clearances and increasing rubbing friction.
5. Leaking check valves or relief valves in pump.
6. Improper functioning of oil cooler or of water to cooler cut-off.

MACHINERY'S Data Sheet No. 568, August, 1946

Compiled by J. C. Van Gundy
The Texas Co., New York

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS


MACHINE SHOP
TRAINING COURSE
ELEMENTARY AND ADVANCED MACHINE SHOP PRACTICE
FOR SHOP COURSES, SCHOOLS AND SELF INSTRUCTION

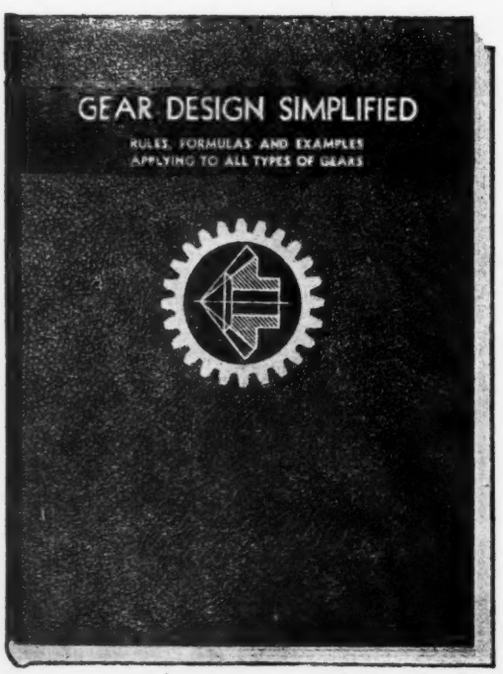
Price $6 Set—Payable $2 with Order, $2 Monthly

This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains over 1100 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified



Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm-gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

CRACKEN. Mr. McCracken has been made district manager of sales of the company's new office in Cleveland.

DR. JAMES T. EATON, formerly research assistant to the vice-president of E. F. Houghton & Co., Philadelphia, Pa., manufacturer of industrial oils, chemicals, and leathers, has been made manager of research. HENRY H. HIGH, previously superintendent of laboratories, has been named superintendent of the Philadelphia oil department, succeeding D. M. Harvey, who has resigned.

WILLIAM E. KNOX has been elected president and general manager of the Westinghouse Electric International Co., Pittsburgh, Pa. Mr. Knox, who became connected with the company as a sales clerk twenty-four years ago, succeeds JOHN W. WHITE, who has resigned to become director general of Industria Electrica de Mexico, one of Mexico's largest privately owned enterprises.

PENN CARBIDE AND ALLOY CASTING CO., Canonsburg 2, Pa., has been established to furnish carbide and cast dies in a wide variety of standard shapes and sizes, as well as special designs. The dies are either tungsten carbide, cast non-ferrous alloy, or cast-to-shape tool steel.

R. C. GARLICK has been made assistant sales vice-president, and G. FINLEY GRIFFITHS general sales manager of the Sharon Steel Corporation, Sharon, Pa. Mr. Garlick has been with the company since 1909, and Mr. Griffiths since 1938.

THOMAS LORD, formerly vice-president of the Lord Mfg. Co., Erie, Pa., manufacturer of vibration control equipment, has been elected president of the company to succeed his father, H. C. LORD, who becomes chairman of the board.

CAREY-MCFALL CO., 2156 E. Dauphin St., Philadelphia 25, Pa., has been appointed distributor of hard metal carbide products for the Carboloy Company, Inc., Detroit, Mich., in Philadelphia and the adjacent territory.

R. NEVIN WATT has been appointed general manager of sales of the Baldwin Locomotive Works, Eddystone, Pa. J. M. STURGES has been made district manager of the northeastern district, with headquarters in New York City.

JOSEPH N. PETERS has been made manager of the Carbide and Cast Alloy Division of the Jessop Steel Co., Washington, Pa. Mr. Peters has had over twenty years' experience in the carbide and cast alloy industry.

ALLEGHENY LUDLUM STEEL CORPORATION announces that the executive offices of the company have been returned to the Henry W. Oliver Bldg., Pittsburgh, Pa. They were temporarily located at Brackenridge during the war period.

LIEUTENANT WILLIAM K. STAMETS, JR., has resumed his duties with the Wm. K. Stamets Co., machine tool distributor in Pittsburgh and Cleveland after having served in the Navy during the war.

ARTHUR BATTS, president of the Carborundum Co., Niagara Falls, N. Y., has been appointed a member of the board of trustees of the Industrial Hygiene Foundation, Pittsburgh 13, Pa.

J. W. WEINGARTNER has been made production control manager of the Brown Instrument Co., Philadelphia, Pa. He will also direct purchasing.

Wisconsin and Missouri

KEARNEY & TRECKER CORPORATION, Milwaukee 14, Wis., announces the opening of three new direct factory sales and service offices, at Detroit, Cleveland, and Pittsburgh. WILLIAM J. MIRGELER and WALTER S. RYAN will be in charge of the Detroit office, and JOHN E. BRENNAN will have charge of the Cle land and Pittsburgh offices. THE MOTCH & MERRYWEATHER MACHINERY CO., formerly represented the Kearney & Trecker Corporation in these territories.

F. F. SIMON has been appointed vice-president and controller of the Wagner Electric Corporation, St. Louis, Mo.; G. A. WATERS has been made vice-president in charge of manufacturing; and K. M. COGGESHALL, assistant vice-president in charge of production and purchasing.

Coming Events

AUGUST 22-24 — National West Coast Transportation and Maintenance Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the New Washington Hotel, Seattle, Wash. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 11-12 — National Tractor Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 12-14—Twenty-third annual convention of the NATIONAL ASSOCIATION OF FOREMEN at the Forest Park Hotel in St. Louis, Mo. Further information can be obtained from the convention headquarters in St. Louis or from the national office of the Association at 11 W. Monument Bldg., Dayton 2, Ohio.

SEPTEMBER 16-20 — 1946 Exhibit and conference of the INSTRUMENT SOCIETY OF AMERICA at the William Penn Hotel in Pittsburgh, Pa. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

SEPTEMBER 18-19—Fall meeting of the AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION at the Homestead, Hot Springs, Va. Executive secretary, Thomas A. Fernley, Jr., 505 Arch St., Philadelphia 6, Pa.

SEPTEMBER 30 - OCTOBER 3 — Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Boston, Mass. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

OCTOBER 3-5 — Aeronautic meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

OCTOBER 3-5—SECOND NATIONAL ELECTRONICS CONFERENCE at the Edgewater Beach Hotel in Chicago, Ill. Further information can be obtained from C. A. Emery, chairman of the publicity committee, 20 N. Wacker Drive, Chicago 6, Ill.

OCTOBER 10-12—Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the William Penn Hotel, Pittsburgh, Pa. H. E. Conrad, executive secretary, 1666 Penobscot Bldg., Detroit 26, Mich.

OCTOBER 16-17 — National Transportation and Maintenance Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Knickerbocker, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 7-8 — National Fuels and Lubricants Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Mayo Hotel, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 18-22 — Annual meeting of the AMERICAN WELDING SOCIETY at Atlantic City, N. J., in conjunction with the National Metal Congress and Exposition. Secretary, M. M. Kelly, 33 W. 39th St., New York 18, N. Y.

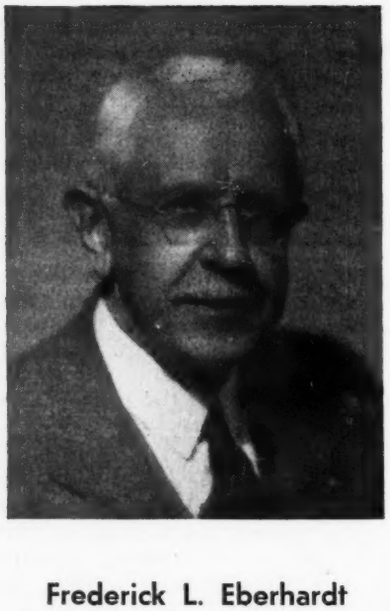
NOVEMBER 18 - 22 — NATIONAL METAL CONGRESS AND EXPOSITION in Atlantic City, N. J., under the auspices of the American Society for Metals. For further information, address managing director, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

DECEMBER 2-4—National Air Transport Engineering Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Edgewater Beach Hotel, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 2-6—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

DECEMBER 2-7—SEVENTEENTH NATIONAL POWER SHOW at Grand Central Palace, New York. Further information can be obtained from the manager, Charles F. Roth, Grand Central Palace, New York 17, N. Y.

Obituaries



Frederick L. Eberhardt

Frederick L. Eberhardt, chairman of the board of Gould & Eberhardt, Inc., Irvington, N. J., machine tool manufacturers, died on July 18 at his home in Maplewood, N. J., aged seventy-eight years. Mr. Eberhardt had been associated with Gould & Eberhardt for sixty-five years. He started work in his father's shop when he was only thirteen years old. Twenty years later, upon the death of his father, he became president and general manager, and continued in this capacity until last January, when he was made chairman of the board.

Mr. Eberhardt was born in Newark and attended the public schools of that city. He was the sixth pupil to be admitted to the Newark Technical School when it was founded in 1885, and in 1911 he was appointed a trustee of this school.

A recognized leader in the machine tool industry, Mr. Eberhardt belonged to the group of pioneer machine tool manufacturers who did so much to bring the industry to the high state of development that made it a vital factor in the successful prosecution of the war. He served as president of the National Machine Tool Builders' Association from 1907 to 1909, and was very active in the work of the Association. He was a member of the American Society of Mechanical Engineers for fifty-seven years, being elected a Fellow of the Society in 1941, when he had completed fifty years as a member. For more than twenty-five years he was an active member of the Society of Automotive Engineers. He also took a prominent part in local civic, business, and educational activities. In addition to being president of the board of trustees of the Newark Technical School and the Newark College of Engineering, he was a member of the Maplewood Civic Association and the Newark Chamber of Commerce, as well as a director of the Fidelity Union Trust Co. of Newark.

Mr. Eberhardt's genial personality, as well as his outstanding achievements in the engineering and business world, won him the admiration and regard of a wide circle of friends. He is survived by his wife, a son—Frederick G. Eberhardt—and two daughters.

Albert R. Stedfast

Albert R. Stedfast, president of Stedfast & Roulston, Inc., well-known machinery dealers of Boston, Mass., died on July 7 in his seventy-sixth year, at his home in Weston, Mass. Mr. Stedfast was born in East Boston on August 17, 1870. He became associated with the machine tool field before he had reached the age of fourteen. It was on July 7, 1884, that he entered the employ of Hill, Clarke & Co., Inc., of Boston, with which company he was connected for over forty years as a member of the sales division, ultimately becoming sales manager and secretary of the firm. In 1927,

Albert R. Stedfast

Mr. Stedfast became the first president of Stedfast & Roulston, Inc., which firm succeeded Hill, Clarke & Co., Inc.,

Mr. Stedfast was exceptionally well known in the machine tool field and the machine-using industries, having spent sixty-two years in this line of activity. He was highly thought of by all who knew him, and his passing will be deeply regretted by his host of friends. He is survived by his wife and three sons—James C., Albert M., and Stanley W., the latter two being officers of the firm of Stedfast & Roulston, Inc.

PAUL E. BOOTH, a partner in the Oatis-Booth Machinery Co., Toledo, Ohio, died at Indianapolis, Ind., on June 30 at the age of forty-six years. Mr. Booth had been connected for a number of years with the machine tool distributing business.

New Books

INVOLUTOMETRY AND TRIGONOMETRY. Computed and compiled by Dr. Werner F. Vogel. 321 pages, 8 by 11 inches. Published by Michigan Tool Co., Detroit, Mich. Price, $20.

This outstanding volume, which the author and publishers hope will be of major assistance to the gear engineer, is dedicated to the American gear industry. The book consists of a main table and three appendixes. The main table completely covers trigonometric values, as well as those used for involutometry—the art of measuring and calculating involutes. The values are given for each degree and hundredth of a degree. These tables are intended to simplify engineering calculations related to the design and manufacture of products based on involute curves and surfaces, such as gears, cutters for cutting gears, splines, etc.

The book classifies the various involute curves and surfaces, describes their geometrical properties, and gives the basic calculations related to them. Tables of derivatives, integrals of involutometry, and graphical characteristics are included for ready reference. A system of involute tracing tables is included in an appendix which may well cause an important change in the present methods of laying out involutes to an enlarged scale, because these tracing tables permit a considerable increase in the scale of enlargement, as well as in accuracy and convenience. Of special value and importance is the appendix containing many entirely new tables of gear formulas of value to the gear engineer. It should be distinctly emphasized, however, that the trigonometric tables, and many of the other tables and formulas, are applicable to the work of engineers in any branch, and are not confined to gear engineering alone. Dr. Werner F. Vogel, who computed and compiled the book, is associate professor of engineering at Wayne University, Detroit, and an academic member of the American Gear Manufacturers Association. The work represents a great deal of painstaking effort.

HOW TO SUPERVISE PEOPLE. By Alfred M. Cooper. 162 pages, 5 by 7 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $2.

This is the second edition of a book on the principles of industrial supervision, the first edition of which was published just before the United States entered the war. Mindful of the changes that have taken place in the industrial employment outlook, the author has made such revisions in the text as will bring the material up to date, and has added a new chapter dealing with the supervisor's responsibility for improving his company's public relations. The questions for group discussion have been added to and revised.

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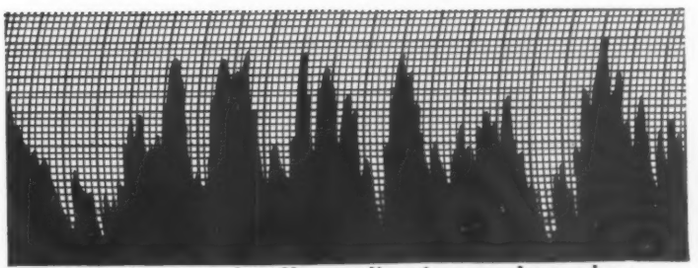
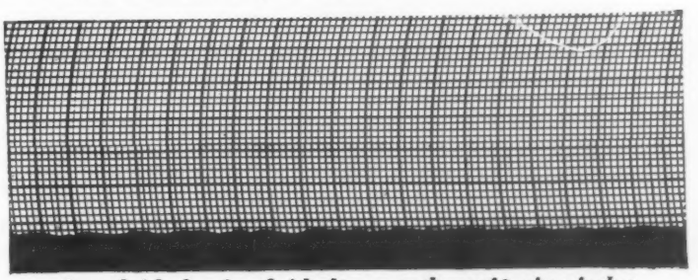
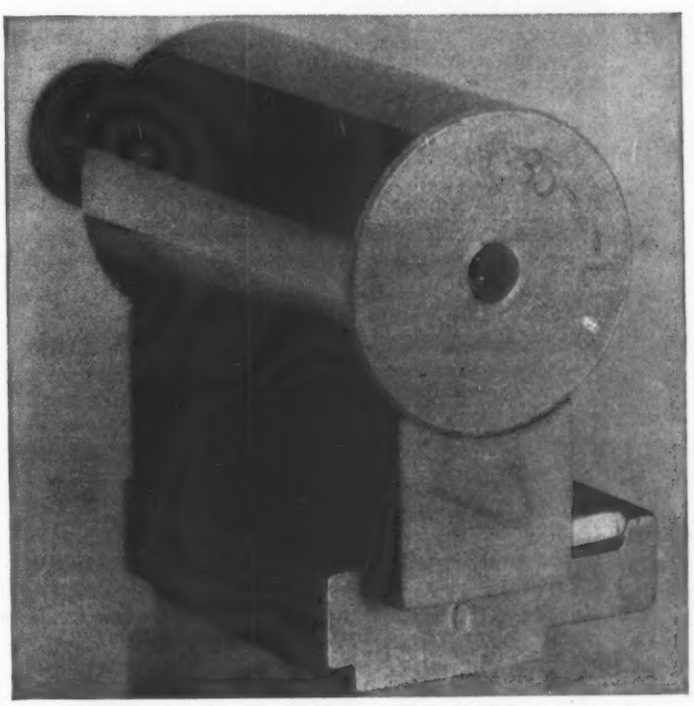
with Gisholt



Above is an actual profile recording of a normal ground surface as shown by the Brush Surface Analyzer. Surface roughness is 20 micro-inches, R. M. S.



Superfinished surface finished to a smoothness of 3 micro-inches, R. M. S. Profile is exact Brush Surface Analyzer recording.



A Superfinished stud and the stone with which the operation is performed. The stone wears to conform to the average radius of the part, then acts as a master *surface to eliminate waviness.*

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Classified Contents of This Number

Design, Fixture and Tool

Proposed Revision of Simplified Practice for Grinding Wheels 185
Double-Acting Attachment Permits Deep Drawing on a Single-Acting Press—*By Fred B. Money*..... 195
General-Purpose Jig for Drilling Small Levers..... 197

Design, Machine

American Standards Catalogue Available..... 149
Industry Conference on Ball and Roller Bearings.... 170
High-Speed Chain Drives for Automatic Screw Machines 172
Rotating Disk-and-Pin Mechanism for Controlling Cutter-Head Slide of Automatic Cam-Generating Device—*By Charles Golosman*..... 189
Automatic Back-Gear Shifter—*By W. F. MacGlashan, Jr.* 193

Management Problems

Successful Employment of Blind Veterans..... 156
Surplus Equipment Should be Available to Educational Institutions at Reasonable Prices..... 174
A Step toward Real Union-Management Cooperation. 188
Needless Accuracy May Add Greatly to Cost of Production 188
Service Guarantees for Equipment..... 194

Materials, Metals, and Alloys

Cemented Carbides Used for Other Purposes than Cutting Tools—*By K. R. Beardslee*..... 150
Material for High-Strength Clutch Plate..... 194
Self-Emulsifying Solvent Utilizes "Constant-Float" Protection 198
More Even Distribution of Free Carbides Improves High-Speed Steels 198
Thermoplastic Air-Drying Coating for Plating-Rack Protection 198
Cleaning Compound for Flexible Abrasives and Metal Files 199
Improvements in Molding Technique Widen Mycalex Applications 199
Inks for Marking Plastics, Rubber, and Insulated Wire 199
Plastic with Unusual Resistance to Acids and High Temperatures 199
Rust-Preventing Compound for Short-Period Protection 199
Three Cutting-Oil Bases with Wide Field of Application 200
Plastic Coating for Protecting Metal Products..... 200
Centrifugally Cast Aluminum-Bronze Bushing Stock 200
Two Saran Coating Materials Provide Moisture-Vapor Protection 200
Aluminum Alloy Combines Strength and Free-Machining Properties 200

News of Industry

Gearing Industry Reports Increased Sales..... 166
Westinghouse Training Course on Electrical Instruments 172
New Plastics Molding Film..... 185
Engineering News 186
Drop Forging Association Elects Officers..... 193
A New Development in Railroad Locomotive Diesel Engines 197
News of the Industry..... 236

Shop Practice

Cold-Forming Oldsmobile Three-Piece Bumpers—*By Charles O. Herb*..... 141
When Coolants Should be Used with Carbide Tools.. 149
Speeds, Feeds, and Lubricants for Reaming..... 157
Hydraulic Oils for Industrial Equipment—*By J. C. Van Gundy*..... 158
Troubles in Steam Turbines or Other Rotating Equipment Detected by Resonance Tube..... 171
Protecting Cutting Tools during Shipment and Storage 171
Cleaner Products Obtained by Exhausting Fine Chips from Milling Machines..... 172
Machine Tool Scale Models and Templets for Plant Lay-outs 175
Life Tests of Single-Point Cutting Tools Now Standardized 175
From Aluminum Oxide to Rolled Aluminum Sheets.. 176
Rapid Milling of Propeller-Shaft Bearings..... 180
Induction Heating Applications in the Machine-Building Industries 181
Governing Factors in Holding Machining Costs to a Minimum 185
Shop Equipment News..... 201
New Method of Preparing Bearing Shells for Babbitting 226
A New Scribing Plate for Optical Comparators..... 226
Nitriding Stainless Steels..... 234

Welding and Cutting Practice

Resistance Welding with Storage-Battery Power.... 167
Arc Welding of Alloy Steels..... 173
Eliminating Distortion in Torch Cutting Operation. 185

Your Progress Depends Upon Your Knowledge of Your Industry

PERIPHERAL SPEEDS OF GRINDING WHEELS AND CORRESPONDING REVOLUTIONS PER MINUTE—1

(Body of Table Gives Revolutions per Minute)

Diameter of Wheel in Inches	Peripheral Speed in Feet per Minute							
	4000	4500	5000	5500	6000	6500	7000	7500
1	15,279	17,189	19,098	21,008	22,918	24,828	26,737	28,647
2	7,639	8,594	9,549	10,504	11,459	12,414	13,368	14,328
3	5,093	5,729	6,366	7,003	7,639	8,276	8,913	9,549
4	3,820	4,297	4,775	5,252	5,729	6,207	6,685	7,162
5	3,056	3,438	3,820	4,202	4,584	4,966	5,348	5,730
6	2,546	2,865	3,183	3,501	3,820	4,138	4,456	4,775
7	2,183	2,455	2,728	3,001	3,274	3,547	3,820	4,092
8	1,910	2,148	2,387	2,626	2,865	3,103	3,342	3,580
10	1,528	1,719	1,910	2,101	2,292	2,483	2,674	2,865
12	1,273	1,432	1,591	1,751	1,910	2,069	2,228	2,386
14	1,091	1,228	1,364	1,500	1,637	1,773	1,910	2,046
16	955	1,074	1,194	1,313	1,432	1,552	1,672	1,791
18	849	955	1,061	1,167	1,273	1,379	1,485	1,591
20	764	859	955	1,050	1,146	1,241	1,337	1,432
22	694	781	868	955	1,042	1,128	1,215	1,302
24	637	716	796	875	955	1,034	1,115	1,194
26	588	661	734	808	881	955	1,028	1,101
28	546	614	682	750	818	887	955	1,023
30	509	573	637	700	764	828	891	955
32	477	537	597	656	716	776	836	895
34	449	505	562	618	674	730	786	843
36	424	477	530	583	637	690	742	795
38	402	452	503	553	603	653	704	754
40	382	430	478	525	573	620	669	716
42	366	409	454	500	545	591	636	682
44	347	390	434	478	521	564	608	651
46	333	375	416	458	500	541	582	624
48	318	358	398	438	478	517	558	597
53	288	324	360	395	432	468	503	539
60	255	287	319	350	387	414	446	478
72	212	239	265	291	318	345	371	398

MACHINERY'S Data Sheet No. 545, September, 1945 From American Standard Safety Code for Abrasive Wheels

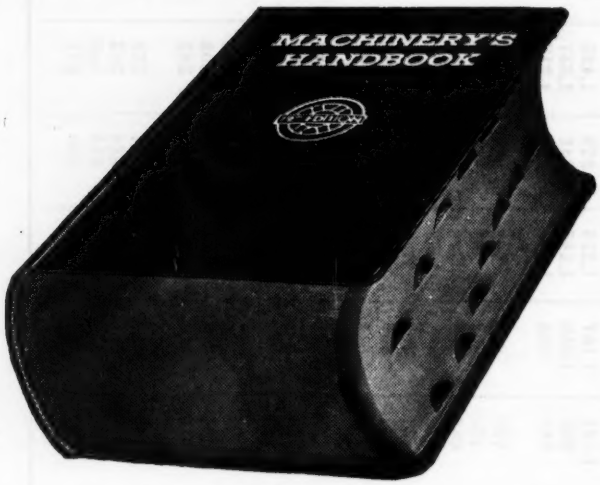
PERIPHERAL SPEEDS OF GRINDING WHEELS AND CORRESPONDING REVOLUTIONS PER MINUTE—2

(Body of Table Gives Revolutions per Minute)

Diameter of Wheel in Inches	Peripheral Speed in Feet per Minute							
	8000	8500	9000	9500	10,000	12,000	14,000	16,000
1	30,558	32,467	34,377	36,287	38,196	45,836	53,474	61,116
2	15,278	16,238	17,188	18,143	19,098	22,918	26,737	30,558
3	10,186	10,822	11,459	12,115	12,732	15,278	17,826	20,372
4	7,640	8,116	8,595	9,072	9,549	11,459	13,368	15,278
5	6,112	6,494	6,876	7,258	7,640	9,168	10,696	12,224
6	5,092	5,411	5,729	6,048	6,366	7,639	8,913	10,186
7	4,366	4,538	4,911	5,183	5,456	6,548	7,640	8,732
8	3,820	4,058	4,297	4,535	4,775	5,729	6,685	7,640
10	3,056	3,247	3,438	3,629	3,820	4,584	5,348	6,112
12	2,546	2,705	2,864	3,023	3,183	3,820	4,456	5,092
14	2,182	2,319	2,455	2,592	2,728	3,274	3,820	4,366
16	1,910	2,029	2,149	2,268	2,387	2,865	3,342	3,820
18	1,698	1,803	1,910	2,016	2,122	2,546	2,970	3,396
20	1,528	1,623	1,719	1,814	1,910	2,292	2,674	3,056
22	1,388	1,476	1,562	1,649	1,736	2,084	2,430	2,776
24	1,274	1,353	1,433	1,512	1,591	1,910	2,228	2,546
26	1,176	1,248	1,322	1,395	1,468	1,762	2,056	2,352
28	1,092	1,159	1,228	1,296	1,364	1,637	1,910	2,182
30	1,018	1,082	1,146	1,210	1,274	1,528	1,782	2,036
32	954	1,014	1,074	1,134	1,194	1,432	1,672	1,910
34	898	955	1,011	1,067	1,124	1,348	1,572	1,796
36	848	902	954	1,007	1,061	1,273	1,484	1,698
38	804	854	904	955	1,006	1,206	1,408	1,608
40	764	812	860	908	956	1,146	1,338	1,528
42	732	775	818	863	908	1,090	1,272	1,464
44	694	737	780	824	868	1,042	1,216	1,388
46	666	708	750	791	832	1,000	1,164	1,332
48	636	676	716	756	796	956	1,116	1,272
53	576	612	648	683	720	864	1,006	1,152
60	510	542	574	606	638	774	892	1,020
72	424	451	477	504	530	637	742	849

MACHINERY'S Data Sheet No. 546, September, 1945 From American Standard Safety Code for Abrasive Wheels

MACHINERY'S HANDBOOK



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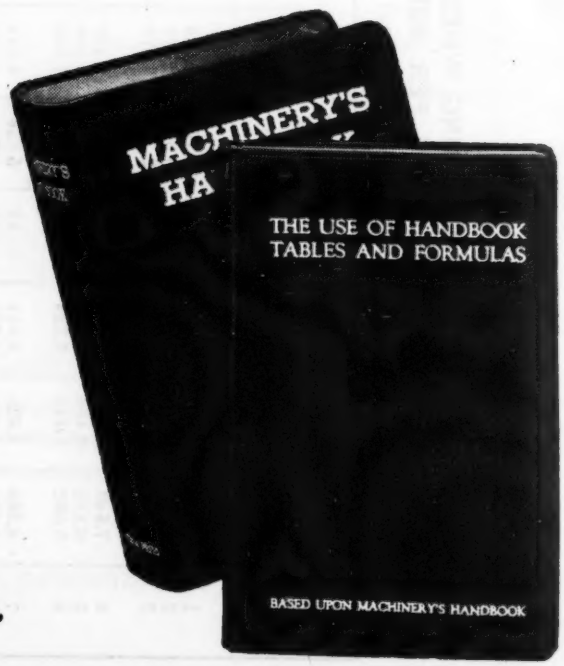

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MACHINERY'S DATA SHEETS 547 and 548

ALLOYS COMMONLY USED FOR NON-FERROUS FORGINGS

Name of Alloy	Composition		Density, Pounds per Cubic Inch	Tensile Strength, 1-inch Specimen, Soft, Pounds per Square Inch	Elongation in 2 Inches, Per Cent	Rockwell Hardness	Best Annealing Temperature, Degrees F.
	Metal	Per Cent					
Forging Brass	Copper Lead Zinc	60.0 2.0 38.0	0.305	52,000	45	F78	800–1100
Naval Brass	Copper Tin Zinc	60.0 0.75 39.25	0.304	57,000	47	B55	800–1100
Leaded Naval Brass	Copper Lead Tin Zinc	60.0 1.75 0.75 37.5	0.305	57,000	40	B55	800–1100
Manganese Bronze	Copper Iron Tin Zinc Manganese	58.5 1.0 1.0 39.2 0.3	0.302	65,000	33	B65	800–1100
Muntz Metal	Copper Zinc	60.0 40.0	0.303	54,000	50	F80	800–1100
Silicon Bronze Type A	Copper Silicon	94.8 Min. 3.0	0.308	58,000	60	B60	900–1300
Silicon Bronze Type B	Copper Silicon	96.0 Min. 1.5	0.316	40,000	50	F55	900–1250

MACHINERY'S Data Sheet No. 547, October, 1945

Compiled by The Brass Forging Association, New York

ALUMINUM ALLOYS COMMONLY USED FOR NON-FERROUS FORGINGS

Alloy	Mechanical Properties					Nominal Chemical Composition			
	Minimum Specification Values				Density	Per Cent of Alloying Elements; Balance Aluminum			
	Tension			Hardness					
Symbol*	Yield Strength, (Set=0.2 Per Cent) Pounds per Square Inch	Ultimate Strength, Pounds per Square Inch	Elongation, Per Cent in 2 Inches	Brinell, 500-KG Load, 10-mm Ball	Pounds per Cubic Inch	Copper	Silicon	Manganese	Magnesium
2S-H	21,000	24,000	15	44	0.098	0	0	0	0
14S-T	55,000	65,000	10	125	0.101	4.4	0.8	0.8	0.4
17S-T	30,000	55,000	16	100	0.101	4.0	0	0.5	0.5
18S-T	40,000	55,000	10	100	0.103	4.0	0	0	0.5
25S-T	30,000	55,000	16	100	0.101	4.5	0.8	0.8	0
32S-T†	40,000	52,000	5	115	0.097	0.9	12.5	0	1.0
A51S-T†	34,000	44,000	12	90	0.097	0	1.0	0	0.6
53S-T†	30,000	36,000	14	75	0.097	0	0.7	0	1.3

*S Signifies wrought alloys; H signifies completely cold-worked; T signifies completely heat-treated.
†32S-T contains 0.9 nickel, and A51S-T and 53S-T each contain 0.25 chromium.

MACHINERY'S Data Sheet No. 548, October, 1945

Compiled by The Brass Forging Association, New York

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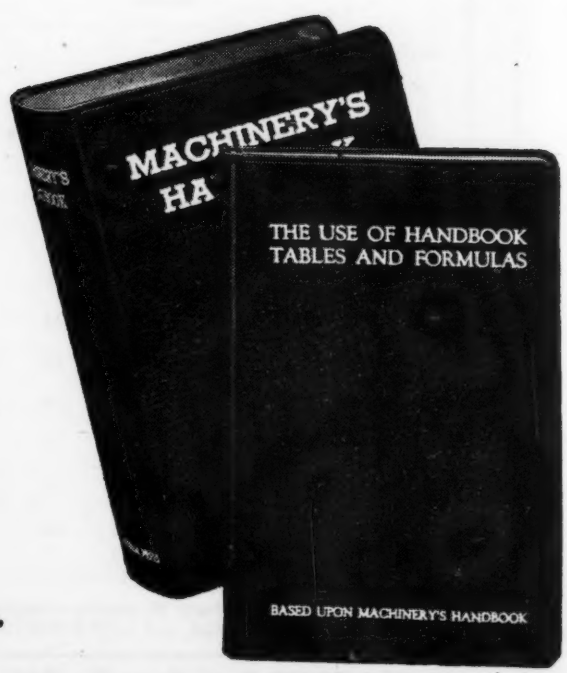

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PRESSURE IN TONS REQUIRED TO PUNCH MILD STEEL PLATE

(Shearing Strength, 50,000 Pounds per Square Inch)

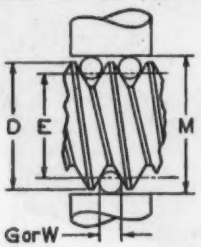
Thickness of Metal		Hole Diameter, Inch							
Gage	Inch	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16
20	0.036	0.35	0.53	0.71	0.88	1.1	1.2	1.4	1.6
18	0.048	0.47	0.71	0.94	1.2	1.4	1.7	1.9	2.1
16	0.060	0.59	0.89	1.2	1.5	1.8	2.1	2.4	2.7
14	0.075	0.74	1.1	1.5	1.9	2.2	2.6	2.9	3.3
12	0.105	1.0	1.6	2.1	2.6	3.1	3.6	4.1	4.7
11	0.120	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3
10	0.135	....	2.0	2.7	3.3	4.0	4.6	5.3	6.0
3/16"	0.187	....	2.8	3.7	4.6	5.5	6.5	7.4	8.3
1/4"	0.250	....	....	4.9	6.2	7.4	8.6	9.8	11.0
3/8"	0.375	....	....	....	....	11.1	13.0	14.8	16.6
1/2"	0.500	....	....	....	....	....	17.2	19.7	22.1

Thickness of Metal		Hole Diameter, Inch						
Gage	Inch	5/8	11/16	3/4	13/16	7/8	15/16	1
20	0.036	1.8	1.9	2.1	2.3	2.5	2.7	2.8
18	0.048	2.4	2.6	2.8	3.1	3.3	3.5	3.8
16	0.060	2.9	3.2	3.5	3.8	4.1	4.4	4.7
14	0.075	3.7	4.1	4.4	4.8	5.2	5.5	5.9
12	0.105	5.2	5.7	6.2	6.7	7.2	7.7	8.3
11	0.120	5.9	6.5	7.1	7.7	8.3	8.8	9.4
10	0.135	6.6	7.3	8.0	8.6	9.3	10.0	10.6
3/16"	0.187	9.2	10.2	11.1	12.0	12.9	13.8	14.8
1/4"	0.250	12.3	13.5	14.8	16.0	17.2	18.5	19.7
3/8"	0.375	18.5	20.3	22.1	24.0	25.8	27.7	29.5
1/2"	0.500	24.6	27.1	29.5	32.0	34.4	36.9	39.4
5/8"	0.625	30.8	33.8	36.9	40.0	43.0	46.1	49.2
3/4"	0.750	....	....	44.3	48.0	51.7	55.4	59.0

Based on Experiments Conducted by the Cincinnati Shaper Co. (Unpublished by Permission)

CONSTANTS FOR THREAD MEASUREMENT BY THREE-WIRE METHOD

American National Standard Thread Form



D = basic major diameter;
E = pitch diameter;
M = size over wires;
G = diameter of "best size" wire;
W = diameter of wire other than "best size";
A, B, C, and F = constants given in table below.

To find M when "best size" wire is employed, use either Formula (2) or (3). When other than "best size" wire is employed, use Formula (4) to find M.

$E = D - A$ (1) $\qquad M = D + C$ (3)

$M = E + B$ (2) $\qquad M = D - F + 3W$ (4)

N	A	B	C	F	G
Number of Threads	$\frac{0.64952}{N}$	$\frac{0.86603}{N}$	$\frac{0.86603}{4 \times N}$	$\frac{1.5155}{N}$	$\frac{0.57735}{N}$
4	0.16238	0.21651	0.05412	0.37887	0.14434
4 1/2	0.14434	0.19245	0.04811	0.33660	0.12830
5	0.12990	0.17321	0.04330	0.30310	0.11547
6	0.10825	0.14434	0.03608	0.25258	0.09623
7	0.09729	0.12372	0.03093	0.21650	0.08248
8	0.08119	0.10825	0.02706	0.18940	0.07217
9	0.07217	0.09622	0.02405	0.16838	0.06415
10	0.06495	0.08660	0.02165	0.15155	0.05774
11	0.05905	0.07873	0.01968	0.13770	0.05249
11 1/2	0.05648	0.07531	0.01883	0.13170	0.05020
12	0.05413	0.07217	0.01804	0.12629	0.04811
13	0.04996	0.06662	0.01665	0.11657	0.04441
14	0.04639	0.06186	0.01546	0.10825	0.04124
16	0.04059	0.05413	0.01353	0.09470	0.03608
18	0.03608	0.04811	0.01203	0.08420	0.03207
20	0.03248	0.04330	0.01082	0.07577	0.02887
24	0.02706	0.03608	0.00902	0.06310	0.02406
27	0.02406	0.03207	0.00802	0.05613	0.02138
28	0.02320	0.03093	0.00773	0.05412	0.02062
32	0.02030	0.02706	0.00676	0.04735	0.01804
36	0.01804	0.02406	0.00601	0.04210	0.01604
40	0.01624	0.02165	0.00541	0.03789	0.01443
44	0.01476	0.01968	0.00492	0.03444	0.01312
48	0.01353	0.01804	0.00451	0.03157	0.01203

Compiled by John Cooper, Jr.
Trenton, N. J.

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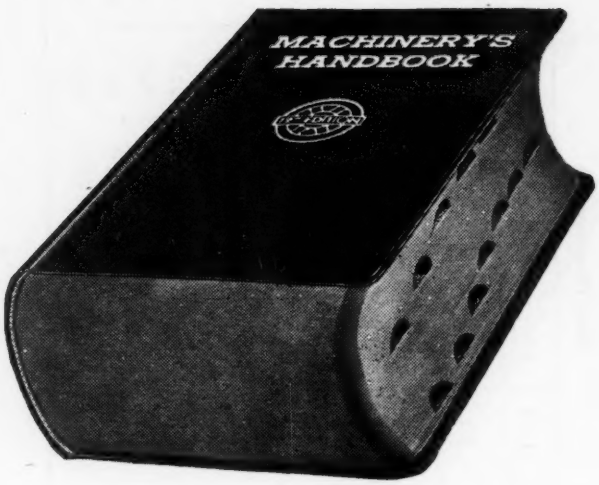

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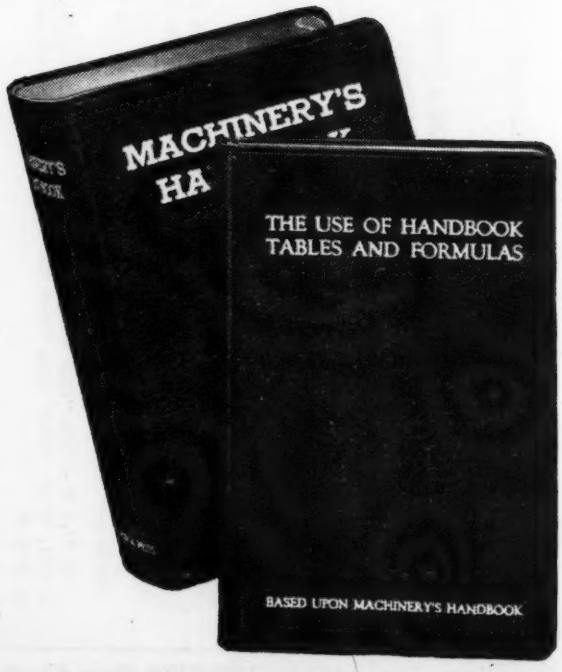

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MACHINERY'S DATA SHEETS 551 and 552

INDUCTION MOTOR "TROUBLE-SHOOTING" CHART—1

Trouble	Cause	Remedy
Motor will not start	Overload control trip	Wait for overload to cool. Try starting again. If motor still does not start, check all causes as outlined below.
	Power not connected	Connect power to control and control to motor. Check clip contacts.
	Faulty (open) fuses	Test fuses.
	Low voltage	Check motor-nameplate values with power supply. Also check voltage at motor terminals with motor under load to be sure wire size is adequate.
	Wrong control connections	Check connections with control wiring diagram.
	Loose terminal-lead connection	Tighten connections.
	Driven machine locked	Disconnect motor from load. If motor starts satisfactorily, check driven machine.
	Open circuit in stator or rotor winding	Check for open circuits.
	Short circuit in stator winding	Check for shorted coil.
	Winding grounded	Test for grounded winding.
	Bearings stiff	Free bearings or replace.
	Grease too stiff	Use special lubricant for special conditions.
	Overload	Reduce load.
Motor noisy	Motor running single phase	Stop motor, then try to start. It will not start on single phase. Check for "open" in one of the lines or circuits.
	Electrical load unbalanced	Check current balance.
	Shaft bumping (sleeve-bearing motors)	Check alignment, and condition of belt. On pedestal-mounted bearing, check cord play and axial centering of rotor.

Compiled by the General Electric Co. Schenectady, N. Y.

INDUCTION MOTOR "TROUBLE-SHOOTING" CHART—2

Trouble	Cause	Remedy
Motor noisy (cont.)	Vibration	Driven machine may be unbalanced. Remove motor from load. If motor is still noisy, rebalance rotor.
	Air gap not uniform	Center the rotor, and if necessary, replace bearings.
	Noisy ball bearings	Check lubrication. Replace bearings if noise is persistent and excessive.
	Loose punchings or loose rotor on shaft	Tighten all holding bolts.
	Rotor rubbing on stator	Center the rotor, and replace bearings if necessary.
	Objects caught between fan and end shields	Disassemble motor and clean it. Any rubbish around motor should be removed.
	Motor loose on foundation	Tighten hold-down bolts. Motor may have to be realigned.
	Coupling loose	Insert feelers at four places in coupling joint before pulling up bolts to check alignment. Tighten coupling bolts securely.
Running at higher than normal temperature or smoking	Overload	Measure motor loading with ammeter. Reduce load.
	Electrical load unbalanced	Check for voltage unbalance or single phasing.
	Fuse blown, faulty control	Check for "open" in one of the lines or circuits.
	Restricted ventilation	Clean air passages and windings.
	Incorrect voltage and frequency	Check motor-nameplate values with power supply. Also check voltage at motor terminals with motor under full load.
	Motor stalled by driven machine or by tight bearings	Remove power from motor. Check machine for cause of stalling.
	Rotor winding with loose connections	Tighten, if possible, or replace with another rotor.
	Belt too tight	Remove excessive pressure on bearings.
	Motor used for rapid reversing service	Replace with motor designed for this service.

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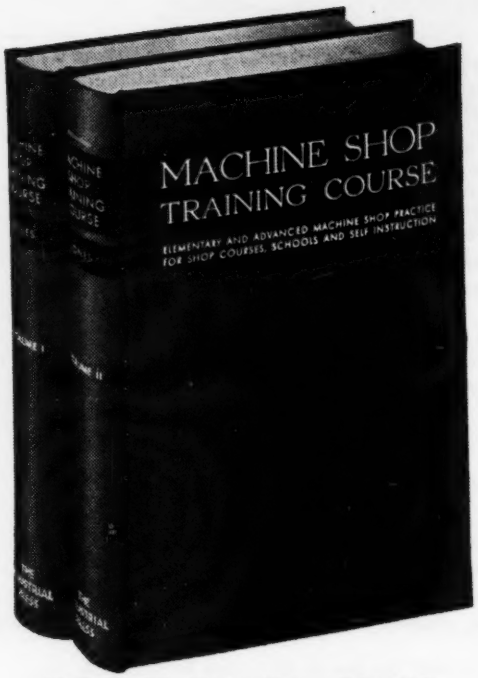
WITH BLUEPRINT READING CHARTS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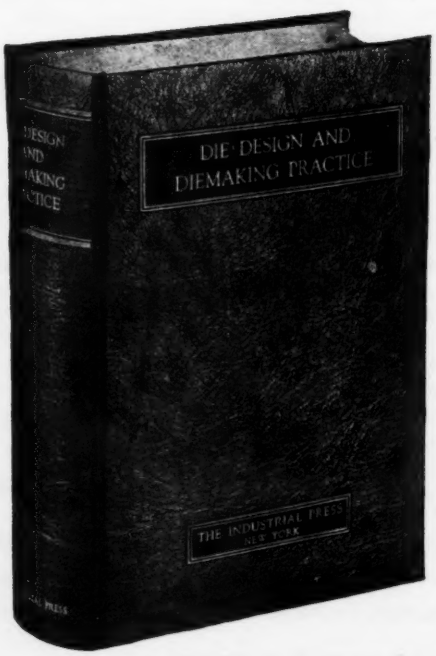

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INDUCTION MOTOR "TROUBLE-SHOOTING" CHART—3

Trouble	Cause	Remedy
Bearings hot	End shields loose or not replaced properly	Make sure end shields fit squarely and are properly tightened.
	Excessive belt tension or excessive gear side thrust	Reduce belt tension or gear pressure and realign shafts. See that thrust is not being transferred to motor bearing.
Bearings hot (Sleeve bearings)	Bent shaft	Straighten shaft, or send to a service shop.
	Insufficient oil	Add oil. If oil supply is very low, drain, flush, and refill.
	Foreign material in oil or poor grade of oil	Drain oil, flush, and relubricate using industrial lubricant recommended by a reliable oil company.
	Oil-rings rotating slowly or not rotating at all	Oil too heavy; drain and replace. Oil-ring has worn spot; replace with new ring.
	Motor tilted too far	Level motor or reduce tilt, and realign if necessary.
	Rings bent or otherwise damaged in reassembling	Replace rings.
	Ring out of slot (oil-ring retaining clip out of place)	Adjust or replace retaining clip.
	Motor tilted, causing end thrust	Level motor, reduce thrust, or use motor designed for thrust.
	Defective bearings or rough shaft	Replace bearings. Resurface shaft.

Compiled by the General Electric Co.
Schenectady, N. Y.

INDUCTION MOTOR "TROUBLE-SHOOTING" CHART—4

Trouble	Cause	Remedy
Bearings hot (Ball bearings)	Too much grease	Remove relief plug and let motor run. If excess grease does not come out, flush and relubricate.
	Wrong grade of grease	Add proper grease.
	Insufficient grease	Remove relief plug and regrease bearing.
	Foreign material in grease	Flush bearings, relubricate; make sure that grease supply is clean. (Keep grease can covered when not in use.)
	Bearings misaligned	Align motor and check bearing housing assembly. See that races are exactly 90 degrees with shaft.
	Bearings damaged (corrosion, etc.)	Replace bearings.
Wound-rotor motor troubles. Motor runs at low speed with external resistance cut out	Wires to control too small	Use larger cable to control.
	Control too far from motor	Bring control nearer to motor.
	Open circuit in rotor circuit (including cable to control)	Test by "ringing" out circuit and repair.
	Dirt between brush and rings	Clean rings and insulation assembly.
	Brushes stuck in holders	Use right size brush.
	Incorrect brush tension	Check brush tension and correct.
	Rough collector rings	File, sand, and polish rings.
	Eccentric rings	Turn in lathe or use portable tool to true up rings without disassembling motor.
	Excessive vibration	Balance motor.
	Current density of brushes too high (overload)	Reduce load. (If brushes have been replaced, make sure they are of the same grade as originally furnished.)

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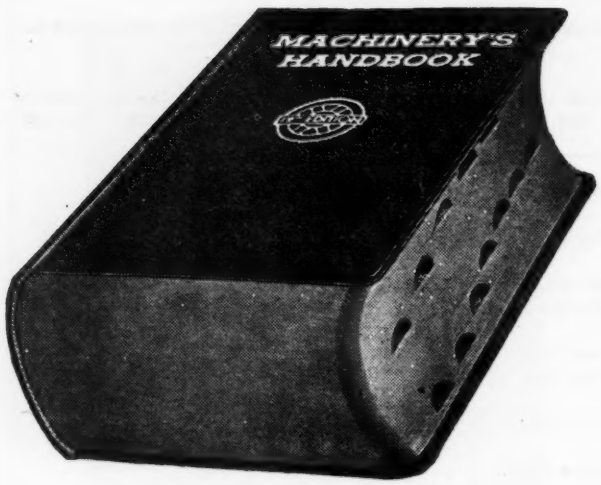

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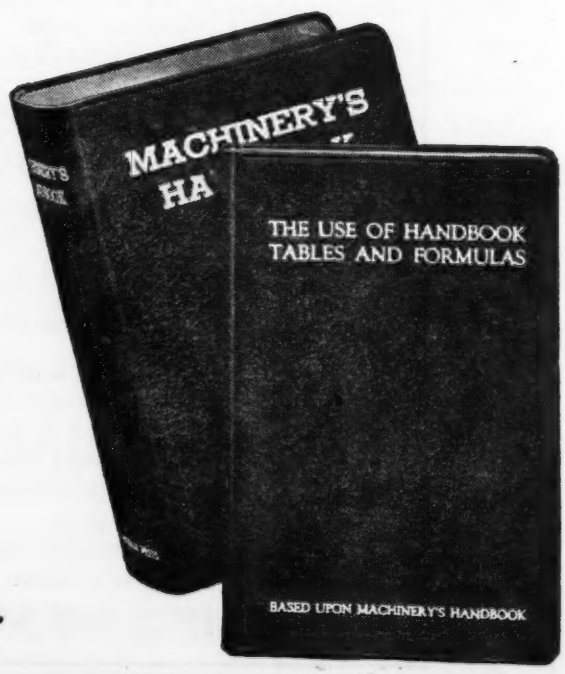

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MACHINERY'S DATA SHEETS 555 and 556

DIRECT-CURRENT MOTOR AND GENERATOR "TROUBLE-SHOOTING" CHART—1

Trouble	Cause	Remedy
Motor will not start	Open circuit in control	Check control for open starting resistor, open switch, or burned fuse.
	Low terminal voltage	Check voltage with nameplate rating.
	Bearing frozen	Recondition shaft and replace bearing.
	Overload	Reduce load or use larger motor.
	Excessive friction	Check lubrication in bearings to make sure that the oil was replaced after installing motor.
		Disconnect motor from driven machine, and turn motor by hand to see if trouble is in motor.
		Strip and reassemble motor; then check, part by part, for proper location and fit.
		Straighten or replace bent or sprung shaft (machines under 5 H.P.).
Motor stops after running short time	Motor is not getting power	Check voltage at the motor terminals; also fuses, clips, and overload relay.
Motor attempts to start, but overload relays operate	Motor is started with weak or no field	If adjustable-speed motor, check rheostat for correct setting. If correct, check condition of rheostat.
		Check field coils for open winding.
		Check wiring for loose or broken connection.
	Motor torque insufficient to drive load	Check line voltage with nameplate rating. Use larger motor or one with suitable characteristic to match load.

MACHINERY'S Data Sheet No. 555, February, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

DIRECT-CURRENT MOTOR AND GENERATOR "TROUBLE-SHOOTING" CHART—2

Trouble	Cause	Remedy
Motor runs too slow under load	Line voltage too low	Check and remove any excess resistance in supply line, connections, or control.
	Brushes ahead of neutral	Set brushes on neutral.
	Overload	Check to see that load does not exceed allowable load on motor.
Motor runs too fast under load	Weak field	Check for resistance in shunt-field circuits.
		Check for grounds.
	Line voltage too high	Correct high-voltage condition.
	Brushes back of neutral	Set brushes on neutral.
Sparking at brushes	Commutator in bad condition	Clean and reset brushes.
	Eccentric or rough commutator	Grind and true commutator, also under-cut mica.
	Excessive vibration	Balance armature.
		Check brushes to make sure they ride freely in the holders.
	Broken or sluggish acting brush-holder spring	Replace spring, and adjust pressure to manufacturer's recommendations.
	Brushes too short	Replace brushes.
	Machine overloaded	Reduce load or install larger motor.
	Short circuit in armature	Check commutator, and remove any metallic particles between segments. Check for short between adjacent commutator risers.
		Test for internal shorts in armature and repair.

MACHINERY'S Data Sheet No. 556, February, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

Machine Shop Training Course

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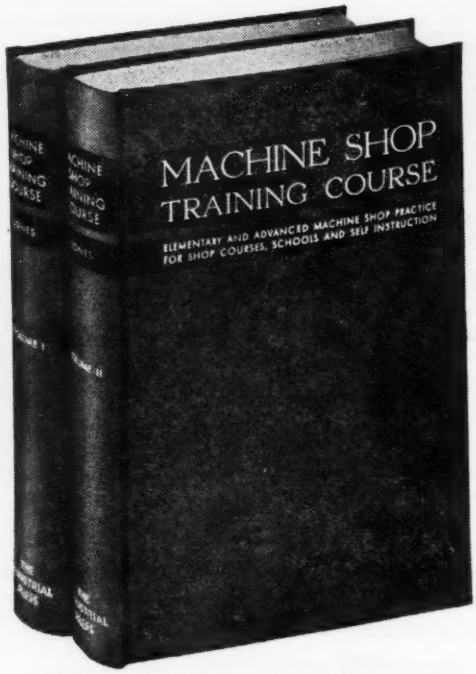
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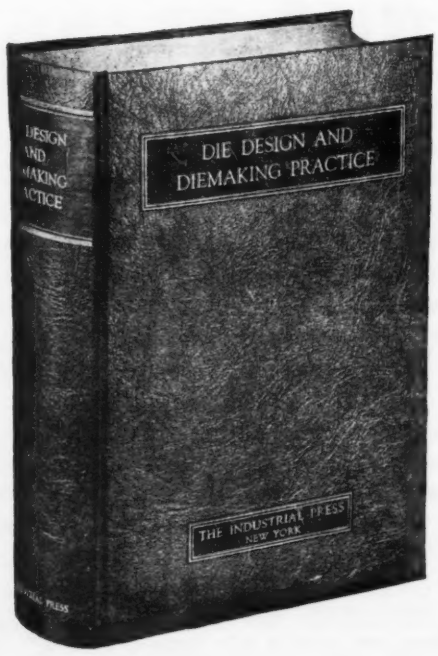

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956 pages, 590 illustrations

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

DIRECT-CURRENT MOTOR AND GENERATOR "TROUBLE-SHOOTING" CHART—3

Trouble	Cause	Remedy
Brush chatter or hissing noise	Excessive clearance of brush-holders	Adjust holders.
	Incorrect angle of brushes	Adjust to the correct angle.
	Incorrect brushes for the service	Get manufacturer's recommendations.
	High mica	Under-cut mica.
	Incorrect brush-spring pressure	Adjust to correct value.
Selective commutation (One brush takes more load than it should)	Insufficient brush-spring pressure	Adjust to correct pressure, making sure brushes ride free in holders.
	Unbalanced circuits in armature	Eliminate high resistance in defective joints by inserting armature or equalizer circuit or commutator risers. Check for poor contacts between bus and bus-rings.
Excessive sparking at brushes	Poor brush fit on commutator	Sand brushes, and polish commutator surface.
	Brushes binding in the brush-holder	Remove and clean holders and brushes with carbon tetrachloride.
		Remove any irregularities on surfaces of brush-holders or rough spots on the brushes.
	Insufficient or excessive pressure on brushes	Adjust brush-spring pressure.
	Brushes off neutral	Set brushes on neutral.

MACHINERY'S Data Sheet No. 557, March, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

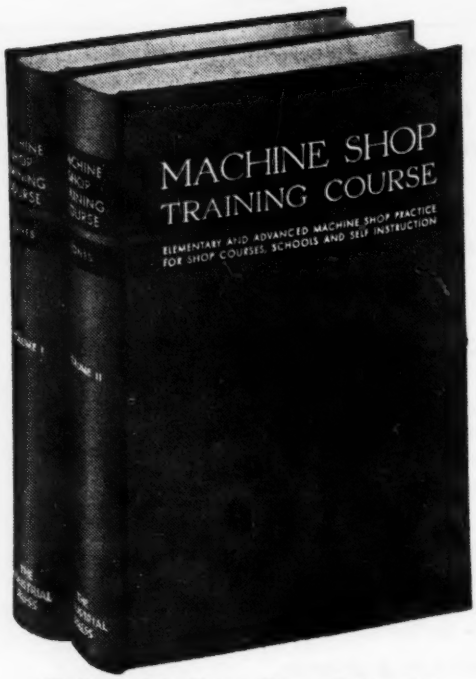
DIRECT-CURRENT MOTOR AND GENERATOR "TROUBLE-SHOOTING" CHART—4

Trouble	Cause	Remedy
Sparking at light loads	Paint spray, chemical, oil or grease, or other foreign material on commutator	Clean commutator, and provide protection against foreign matter. Install an enclosed motor which is designed for the application.
Field coils overheat	Short circuit between turns or layers	Replace defective coil.
Commutator overheats	Brushes off neutral	Adjust brushes.
	Excess spring pressure on brushes	Decrease brush-spring pressure, but not to the point where sparking is introduced.
Grooving of commutator	Brushes not properly staggered	Stagger brushes.
Brushes wear rapidly	Rough commutator	Resurface commutator and under-cut mica.
	Excessive sparking	Make sure brushes are in line with commutating fields.
Armature overheats	Motor overloaded	Reduce load to correspond to allowable load.
	Motor installed in location where the ventilation is restricted	Arrange for free circulation of air around motor.
	Armature winding shorted	Check commutator, and remove any metallic particles between segments.
		Test for internal shorts in armature, and repair.

MACHINERY'S Data Sheet No. 558, March, 1946

Compiled by the General Electric Co. Schenectady, N. Y.

Machine Shop Training Course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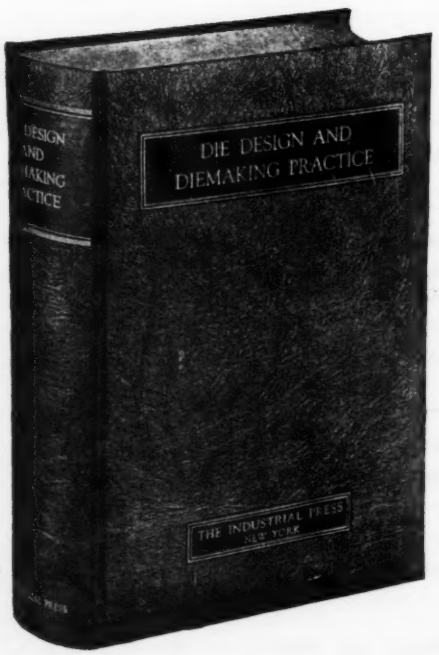

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PROPERTIES OF ALUMINUM ALLOYS FOR PERMANENT-MOLD CASTINGS—1

Aluminum Co. of America's Alloy and Heat-Treatment Numbers	Yield Point, 0.2 Per Cent Set, Pounds per Square Inch	Ultimate Tensile Strength, Pounds per Square Inch	Elongation in 2 Inches, Per Cent	Brinell Hardness, 500-Kg. Load, 10-mm. Diameter Ball
43	9000	24,000	9.0	45
	Characteristics and Typical Applications			
	Especially suited for intricate and thin-walled castings and castings required to be leakproof. Has a high resistance to corrosion and can be welded easily, but is not as easy to machine as some of the other aluminum alloys. Alumilite coatings have a gray color, but are easily applied and offer excellent protection to severely corrosive conditions. This alloy has been used extensively in architectural and marine applications.			
C113	28,000	30,000	1.0	80
	Characteristics and Typical Applications			
	Can be cast easily in normal section thickness, but is not as well suited for thin sections as 43 or 356 alloys. Can be machined more easily than most of the other aluminum alloys. Has been used to a considerable extent for water-cooled cylinder heads and washing machine agitators.			
A132-T551	28,000	36,000	0.5	105
	Characteristics and Typical Applications			
	Used extensively for pistons because of good strength at temperatures of about 500 to 600 degrees F. and about 15 per cent less thermal expansion than most other aluminum alloys. Alumilite coatings increase resistance to abrasion.			
138	24,000	28,000	0.5	100
	Characteristics and Typical Applications			
	Retains hardness well at elevated temperatures and can be cast fairly easily. Can be polished to produce smooth surface with rather high luster. Used principally for sole plates for domestic electric irons.			

MACHINERY'S Data Sheet No. 561, May, 1946

Compiled by the Aluminum Co. of America, Pittsburgh, Pa.

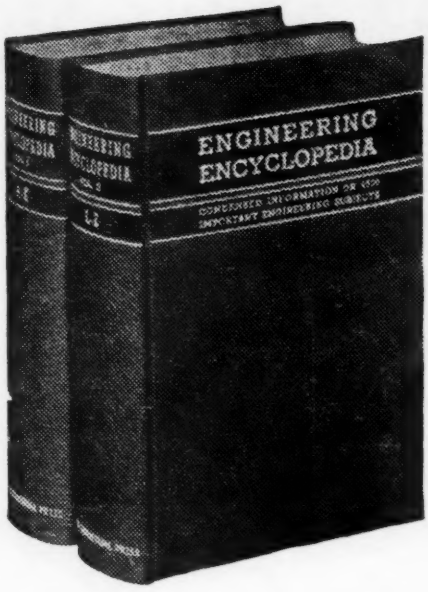
PROPERTIES OF ALUMINUM ALLOYS FOR PERMANENT-MOLD CASTINGS—2

Aluminum Co. of America's Alloy and Heat-Treatment Numbers	Yield Point, 0.2 Per Cent Set, Pounds per Square Inch	Ultimate Tensile Strength, Pounds per Square Inch	Elongation in 2 Inches, Per Cent	Brinell Hardness, 500-Kg. Load, 10-mm. Diameter Ball
B195-T6	33,000	45,000	5.0	90
	Characteristics and Typical Applications			
	Combines good foundry characteristics with good physical properties and resistance to shock, a very good machinability and a good resistance to corrosion. Alumilite coatings have a milky appearance, but afford considerable protection. A commonly used, heat-treatable alloy for structural applications.			
A214	16,000	27,000	7.0	60
	Characteristics and Typical Applications			
	Has a very high resistance to corrosion and can be machined more easily than most other aluminum alloys. Alumilite coatings are clear and have an attractive appearance. Is less easily cast than most of the other alloys. Used chiefly for cooking utensils.			
355-T6	27,000	43,000	4.0	90
	Characteristics and Typical Applications			
	Can be cast easily and is quite useful for leakproof castings requiring good strength. Can be welded with ease, but should be reheat-treated after welding if full strength is important. Alumilite coatings are gray to milky in color. Has a good resistance to corrosion and a fairly good machinability. Used extensively for internal combustion engine parts and structural castings.			
356-T6	27,000	40,000	5.0	90
	Characteristics and Typical Applications			
	Casts well into thin sections and is frequently used when leakproof castings of relatively high strength are required. Has a high resistance to corrosion, but is not as easily machined as a number of the other alloys. Alumilite coatings have a gray color and afford a high degree of protection. Has been used extensively for aircraft wheels, truck frame parts, Diesel engine parts, and many intricate, thin-walled castings.			

MACHINERY'S Data Sheet No. 562, May, 1946

Compiled by the Aluminum Co. of America, Pittsburgh, Pa.

A World of Engineering Knowledge in Two Volumes



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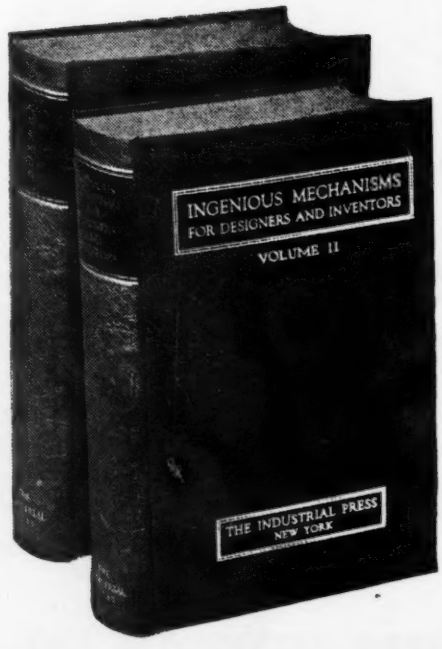

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MACHINERY'S DATA SHEETS 563 and 564

DESIGNATIONS FOR MAGNESIUM ALLOYS

A.S.T.M. Magnesium Alloy Designation	The Dow Chemical Co. "Dowmetal" Alloy Designation	American Magnesium Corporation "AM" Alloy Designation	Nominal Percentage of the Main Alloying Constituents (Not Including Impurities)					
			Aluminum	Zinc	Manganese*	Silicon (Max.)	Tin	Magnesium
A8	A	241	8.5					Remainder
A10	G	240-59S	10.0					"
A12	B	246	12.0					"
AS100	K	230	10.0			1.0		"
AT35	D	65S	3.5				5.0	"
AZ31	FS	52S	3.0	1.0				"
AZ33	X	74S	3.0	3.0				"
AZ51	JS	54S	5.0	1.0				"
AZ61	J	57S	6.5	1.0				"
AZ63	H	265	6.0	3.0				"
AZ80	O	58S	8.5	0.5				"
AZ90	R	263	9.0	0.7				"
AZ92	C	260	9.0	2.0				"
AZ101	P	88S	10.0	1.0				"
M1	M	403-3S			1.5			"

Note: These designations are modified for controlled high-purity alloys, having a low percentage of nickel and iron impurities, by adding X to the A.S.T.M. designation (for example: AZ61X); by adding -1 to the Dow Chemical Co. designation (for example: J-1); and by preceding the American Magnesium Corporation designation with a C (for example: AM-C57S).

*In all alloys except M1, manganese is present as a required constituent in amounts varying from 0.1 to 0.2 per cent.

MACHINERY'S Data Sheet No. 563, June, 1946

Compiled by the Standards Committee of the Magnesium Association

COLOR MARKING CODE FOR COMMONLY USED MAGNESIUM ALLOYS

Adopted by the Magnesium Association

A.S.T.M. Magnesium Alloy Designation	Color Marking*	Usual Forms									
		Sand Castings	Permanent-Mold Castings	Die-Castings	Ingots	Billets	Rolling Slab	Extrusions	Forgings	Sheet	Welding Wire
A8	Black	X			X						X
A10	Purple	X	X		X						X
A12	Yellow-Black	X			X						
AT35	Tan					X		X(Bar)	X		
AZ31	Red					X	X	X	X	X	X
AZ51	Brown					X	X			X	X
AZ61	Gray					X	X	X	X	X	X
AZ63	Green	X	X		X						X
AZ80	White					X		X	X		X
AZ90	Blue			X	X						
AZ92	Orange	X	X		X						X
AZ101	Red-Green	X			X						X
M1	Yellow	X			X	X	X	X	X	X	X

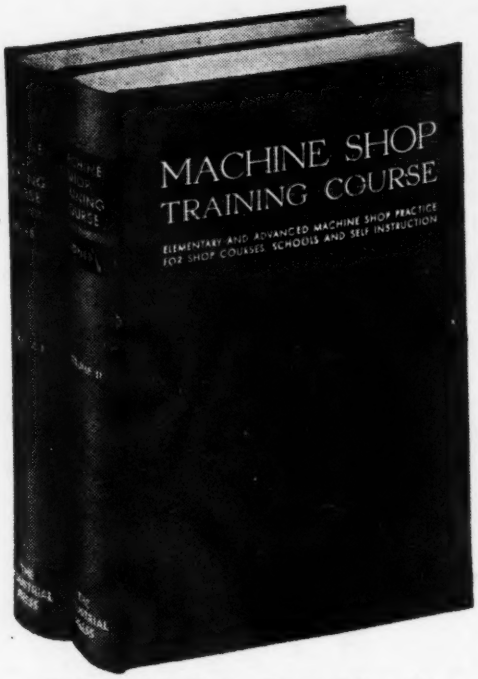
*An aluminum paint stripe is added to these colors for controlled-purity materials, which are indicated by the addition of the letter X to the A.S.T.M. designation.

MACHINERY'S Data Sheet No. 564, June, 1946

Compiled by the Standards Committee of the Magnesium Association

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS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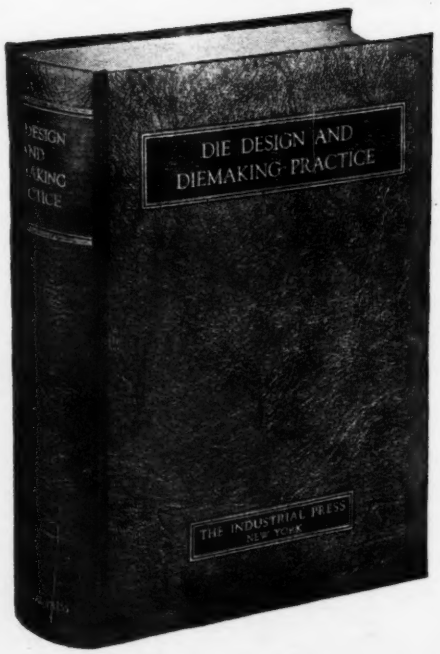

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SYNCHRONOUS MOTOR "TROUBLE-SHOOTING" CHART—1

Trouble	Cause	Remedy
Motor will not start	Faulty connection	Inspect for open or poor connection.
	Open circuit, one phase	Test, locate, and repair.
	Short circuit, one phase	Open and repair.
	Voltage falls too low	Reduce the impedance of the external circuit.
	Friction high	Make sure bearings are properly lubricated.
		Check bearing tightness.
		Check belt tension.
		Check load friction.
		Check alignment.
	Field excited	Be sure field-applying contactor is open and field-discharge contactor is closed through discharge resistance.
	Load too great	Remove part of load.
	Automatic field relay not working	Check power supply to solenoid.
		Check contactor tips.
		Check connections.
	Wrong direction of rotation	Reverse any two main leads.
Motor will not come up to speed	Excessive load	Decrease the load.
		Check operation of unloading device (if any) on driven machine.
	Low voltage	Increase voltage.
	Field excited	Be sure field-applying contactor is open, and field-discharge contactor is closed through discharge resistance.

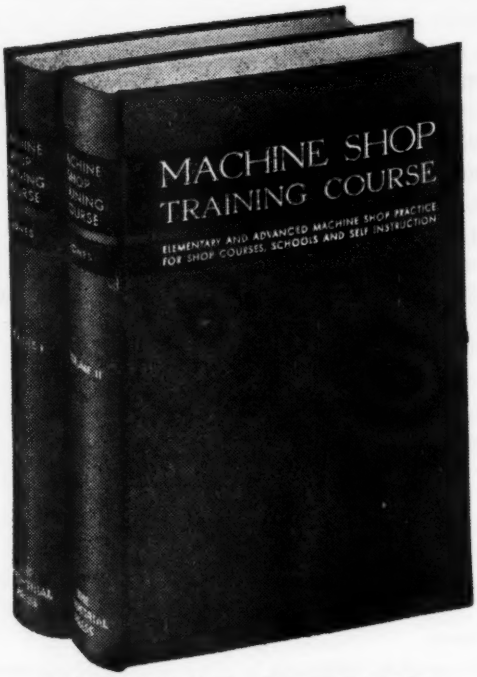
MACHINERY'S Data Sheet No. 565, July, 1946 Compiled by the General Electric Co. Schenectady, N. Y.

SYNCHRONOUS MOTOR "TROUBLE-SHOOTING" CHART—2

Trouble	Cause	Remedy
Motor fails to pull into step	No field excitation	Check circuit connections. Be sure field-applying contactor is operating.
		Check for open circuit in field or exciter.
		Check exciter output.
		Check rheostat.
		Set rheostat to give rated field current when field is applied.
		Check contacts of switches.
	Load excessive	Reduce load.
		Check operation of unloading device (if any) on driven machine.
	Inertia of load excessive	May be a misapplication—consult manufacturer.
Motor pulls out of step or trips breaker	Exciter voltage low	Increase excitation.
		Examine exciter. Check field ammeter and its shunt, to be sure reading is not higher than actual current.
	Open circuit in field and exciter circuit	Test with magneto, and repair break.
	Short circuit in field	Check with low-voltage and polarity indicator, and repair field.
	Reversed field spool	Check with low-voltage and polarity indicator, and reverse incorrect leads.
	Excessive torque peak	Check driven machine for bad adjustment or consult motor manufacturer.
	Failure of power	Re-establish power circuit.
	Line voltage too low	Increase if possible. Raise excitation.

MACHINERY'S Data Sheet No. 566, July, 1946 Compiled by the General Electric Co. Schenectady, N. Y.

Machine Shop Training Course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Gear Design Simplified

Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm-gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price $3 copy.

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"TROUBLE SHOOTING" IN HYDRAULICALLY OPERATED SYSTEMS—1

A. Causes of General Operation Difficulties

1. Use of the wrong type of oil.
2. Insufficient fluid in the system.
3. Presence of air in the system.
4. Mechanical damage or structural failure.
5. Internal or external leakage.
6. Dirt, decomposed packing, water, rust, sludge, etc., in the system.
7. Improper adjustments.
8. Oil cooler plugged or dirty.

B. Failure of Pump to Deliver Flow

1. Low fluid level in reservoir.
2. Pressure and supply lines reversed or motor direction reversed.
3. Pump drive-shaft key sheared.
4. Intake valves plugged.
5. Air leak in suction line.
6. Pump shaft turning too slowly to prime itself.
7. Oil viscosity too heavy to pick up prime.

C. Loss of System Pressure

1. Pump not delivering oil for reasons under B.
2. Low fluid level in reservoir.
3. Excessive leakage—internal or external.
   a. Regulator stuck in the cutout position.
   b. Relief valves unseated by foreign particles.
   c. Leakage at poppets in selector valves.
   d. Pump failure.
   e. Leaky check valve in pressure regulator.
   f. Use of oil having wrong viscosity at operating temperature.
4. Pump not developing pressure.

MACHINERY'S Data Sheet No. 567, August, 1946

Compiled by J. C. Van Gundy
The Texas Co., New York

"TROUBLE SHOOTING" IN HYDRAULICALLY OPERATED SYSTEMS—2

D. Pump Chatter

This is caused by any condition which limits the flow of oil into the suction side of the pump. Possible causes are:

1. Plugged inlet screen.
2. Air leaking into suction side.
3. Sticking of vanes in vane type pumps.
4. Use of an oil having too high a viscosity (particularly true at low temperature).
5. Worn pump.
6. Relief valve chattering.
7. Coupling misalignment.
8. Pump running too fast.

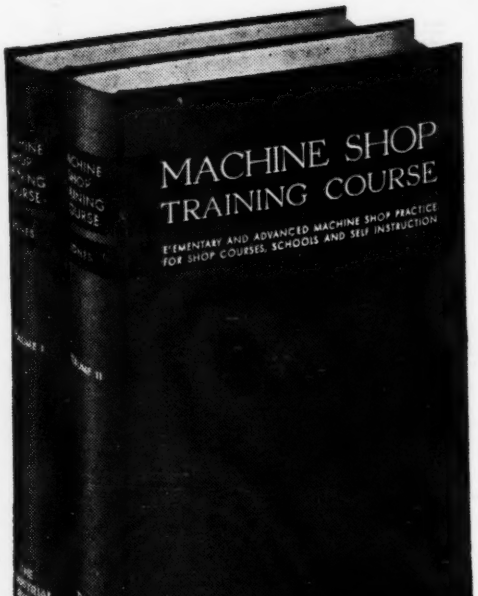
E. Excessive Heating

1. Pump discharging at a higher pressure than necessary due to excessive amount of oil dissipated through relief valve, or throttle valves, or by increased slippage in various parts.
2. Internal oil leakage due to wear.
3. Viscosity of oil too high.
4. Pumps assembled after overhaul may be assembled too tightly, thus reducing clearances and increasing rubbing friction.
5. Leaking check valves or relief valves in pump.
6. Improper functioning of oil cooler or of water to cooler cut-off.

MACHINERY'S Data Sheet No. 568, August, 1946

Compiled by J. C. Van Gundy
The Texas Co., New York

Machine Shop Training Course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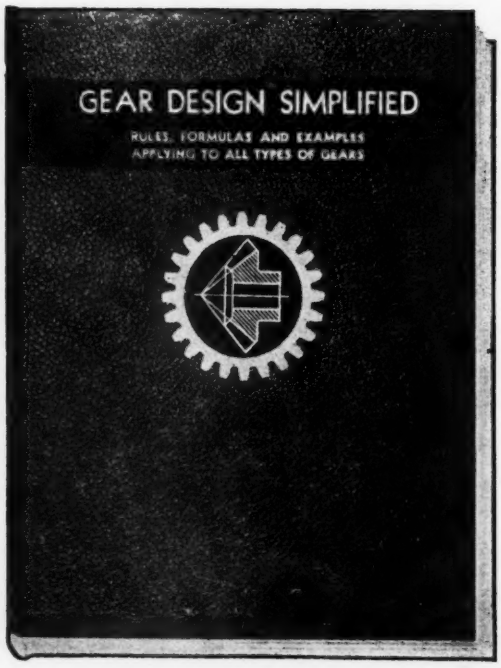

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Index to MACHINERY, Volume 52

A

Abel, Paul, Personal of....May 239
Abrasive Co.:
Mounted Formed Abrasive Points....Dec. 199
Abrasive Cut-off Machine, Buehler....Mar. 220
Abrasive Cut-off Wheels, Bayflex....Feb. 222
Abrasive Points, Mounted Formed....Dec. 199
Abrasive Utility Set, Bay State....Sept. 224
Abrasives and Metal Files, Cleaning Compound for Flexible....Aug. 198
Abrasives for Wet Tumbling, Norton Alundum....Feb. 205
Abrasives Solve Many Reconversion Metal-finishing Problems, Coated....June 174
"Abrasoweld AC" Electrodes for Hard Facing....Mar. 199
Accuracy May Add Greatly to Cost of Production, Needless....Aug. 188
Accurate Machine Products Co.:
"Micro-Planer" Gage....Aug. 216
Acker, David B., Personal of....May 232
Acme-Gridley Single-spindle "Chuck-Matic"....May 193
Acromark Co.:
Inks for Marking Plastics, Rubber, and Insulated Wire....Aug. 199
Adair, James, Personal of....Apr. 246
Adams, E. F.:
Brazing Tool Tips to Shanks by Induction Heating....Dec. 178
Adamson, Harold L., Personal of....May 232
Adamson Machine Co.:
Airplane Tire Testing Machine Simulates Actual Landing Conditions....Mar. 173
Adamson, N. F., Personal of....Nov. 233
Adapter for Small-lot Runs, Form Tools and....Feb. 218
Adhesive for Laminated Construction, Synthetic Plastic....Dec. 197
Adjustment Block, Howard Tool....July 218
Advertising is Good Business, and Good Ethics as Well, Good....Apr. 192
Ahearn, James:
Method of Checking Compound Angles..Dec. 182
Air Collet, Mead....Nov. 215
Air Cylinder, see Cylinder
Air, Film on Industrial Uses of Compressed....June 168
"Air-Horse" Pneumatic Riveting Hammer..Mar. 199
"Air-Horse" Rotary File and Die Grinder..July 208
Air Methods of Silver Brazing, Comparative Study of Electric and Gas-. Paul F. Berg....Jan. 151
Air-Operated Equipment, Redmer Foot Control and Valve for....Dec. 226
Air Reduction Co.:
Torch-cutting of Stainless Steel Made Possible by New Equipment....Sept. 190
Electronic Control Widens Scope of Oxy-acetylene Cutting Machines....Jan. 189
All-position Mild-steel Electrode....Apr. 209
Eliminating Distortion in Torch Cutting Operation....Aug. 185
Extrusion-coated Self-hardening Electrode....Aug. 203
Air Regulating, Filtering, and Lubricating Unit, Logan....Jan. 204
Air-Speed Tool Co.:
Pneumatic Saw and Filing Tool....Dec. 208
Air Technical Service Command:
Floating Machine Shop Keeps Island-based Planes in the Air....Sept. 175
Airco All-position Mild-steel Electrode....Apr. 209
Aircraft Field, New Featherweight Structural Material Developed in....Apr. 200
Aircraft Machinery Corporation:
Armor Milling Machine....May 199
"Air-Draulic" Cylinders, Logan..May 212, June 191
Aireon Mfg. Corporation:
Optical Micrometer....May 220
Air-O-Limit Comparators, Improved....Mar. 214
"Airsnap" Fixtures for Use with Precisionaire Instruments....May 204
Aitchison, Lieutenant Robert S., Personal of....Mar. 228
Ajax-Electrothermic Corporation:
Automatic Induction Heating Equipment for Forging Operations....Sept. 226
Akron Bronze & Aluminum Co.:
Copper Alloy Provides Unusual Strength and Hardness....Apr. 201
Albrecht, Fred, Personal of....Feb. 238
All American Tool & Mfg. Co.:
Precision Die-filing Machine....Feb. 204
All-In-One Tool Co.:
Combination Contour Shaper Bit-holder..May 201
Allegheny Ludlum Steel Corporation:
High-temperature Resisting Alloys....Oct. 161
New Tool Steel with Greatly Improved Machinability....Nov. 174
Allen-Bradley Co.:
Universal Solenoid Relay....Aug. 204
Allen, Robert G., Personal of....Feb. 245
Allis-Chalmers Mfg. Co.:
Betatron Makes X-ray Pictures Through Fifteen Inches of Steel....Jan. 180
Film on Induction Heating....Apr. 198
Alloy Rods Co.:
Cupro-Arc Electrode....Jan. 200
Alloy Steel Products Co., Inc.:
Machining Stainless-steel Valves....July 148
Alloys, High-temperature Resisting....Oct. 161
Alloys in Forty Seconds, Spectrometer Analyzes....Jan. 180
Alloys Now Available for Peacetime Use, Secret Wartime High-temperature....July 183
Allwood, Jr., John A., Personal of....Oct. 240
Almen, John O., Personal of....July 238
Almorth, G. A.:
Simple Gage for Checking Pump Gears..Dec. 193
Alnico 12 Permanent-magnet Material....July 236
Aluminum Adopted for Truck Rear-axle Housings....Aug. 186
Aluminum Aircraft Pistons on Mechanical Presses, Forging, Charles O. Herb....Nov. 149
Aluminum-alloy Bearing Metal for Automobile Engines, New....July 153
Aluminum Alloy Combines Strength and Free Machining Properties....Aug. 200
Aluminum Alloy, Motion Picture on New..May 173
Aluminum and Aluminum Alloys, New Corrosion-resisting Coating for....Dec. 187
Aluminum Automobile Engine with Horizontal Cylinders, Cast-....Apr. 191
Aluminum Bonded to Cellulose Core Forms New Building Material....July 163
Aluminum Brazing. W. E. Brainard....Sept. 143
Aluminum-bronze Bushing Stock, Centrifugally Cast....Aug. 200
Aluminum Co. of America:
Cutting Compounds for Machining Aluminum Alloys....June 168
Aluminum-faced Office Building....July 227
From Aluminum Oxide to Rolled Aluminum Sheets....Aug. 176
Aluminum-faced Office Building, New....July 227
Aluminum, Improved Flux for Gas-welding..Jan. 191
Aluminum, Increasing Application of....July 192
Aluminum Oxide to Rolled Aluminum Sheets, From....Aug. 176
Aluminum Pallets Save Handling Weight and Expense....July 156
Aluminum Piston-forging Operation Has High Flash Point, Lubricant in....Feb. 174
Aluminum Soldering, Brazing, or Gas Welding, Flux for....Dec. 196
Alumox Process for Producing Corrosion-resisting Coating on Aluminum....Dec. 187
Alundum Abrasives for Wet Tumbling, Norton....Feb. 205
Alven, Alfons, Personal of....Aug. 242
Amco No. 4015—A Flux for Aluminum Soldering, Brazing, or Gas Welding....Dec. 196
Amer, Harry S., Personal of....Feb. 238
American Broach & Machine Co.:
Horizontal Broaching Machine....Mar. 194
American Car & Foundry Co.:
High-quality Tank Manufacture....Jan. 135
American Foundrymen's Association:
Fiftieth Anniversary Convention and Exhibit to be Held in Cleveland....Oct. 167
American Gas Furnace Co.:
Automatic Arrangement for Silver-soldering Refrigerator or Condenser Coils....June 178
American Gear Manufacturers Association:
Gear Tooth Wear and Failure....Apr. 166
Thirtieth Annual Meeting Held at Hot Springs....July 164
American Gear & Mfg. Co.:
"White Line" Precision-made Universal Joints....May 222
American Locomotive Co.:
"Merry-Go-Round" Speeds Production of Tanks....Sept. 210
American Machine & Foundry Co.:
Portable Automatic Material-handling Racks....June 217
American Machine Tool Distributors' Association:
Annual Meeting Held in Cleveland....Dec. 198
Recommendations on Surplus Machine Tools....Jan. 161
American Measuring Instruments Corporation:
Quick-action Vernier Calipers....Apr. 232
American Molded Products Co.:
Plastic Pipe Seals....Sept. 161
American Optical Co.:
Anti-fog Preparation for Industrial Goggle Lenses....Sept. 171
Dust Goggle Designed to Provide Greater Safety and Comfort....Jan. 209-C
"Sight-Screener" for Checking Employes' Vision....Apr. 199
American Saw Mill Machinery Co.:
Monarch Uni-Point Radial Saw....Apr. 216
American Society for Metals:
Veterans' Refresher Courses....Oct. 172
National Exposition to be Held in February....Nov. 178
National Metal Congress and Exposition..Jan. 183
Awards Made for Metal Industry Achievements....Mar. 240
American Society of Mechanical Engineers:
D. Robert Yarnall Elected President....Oct. 186
Meeting Held in Cincinnati....Nov. 164
Magnesium Exhibit and Symposium....Jan. 154
Machine Design Group Formed....Feb. 181
Job Evaluation Methods Discussed at Spring Meeting....May 191
Machine Design Group to Hold First Technical Session....June 177
Detroit Meeting Featured Metal Cutting..July 226
American Society of Tool Engineers:
Tool Engineers Plan Exposition....Dec. 146
"New Era" Exposition to be Held in Cleveland....Jan. 161, Mar. 175
Cleveland Convention and Exposition....Apr. 150
New Officers Elected....May 177
New Era Exposition Highly Successful..May 192
American Solder & Flux Co.:
Flux for Aluminum Soldering, Brazing and Gas Welding....Dec. 196
American Standards Association:
Safety Color Code....Sept. 250
Metric Screw Thread Standards....Dec. 238
Safety Code for Industrial Use of X-rays....July 187
Standards Catalogue Available....Aug. 149
Industry Conference on Ball and Roller Bearings....Aug. 170
Life Tests of Single-point Cutting Tools Now Standardized....Aug. 175
American Welding Society:
Prizes for Papers on Resistance Welding....Feb. 246
Undergraduate Welding Award....Feb. 248
Amon, Fred E., Personal of....Aug. 242
Ampco Metal, Inc.:
Motion Picture Entitled "Golden Horizons"....Oct. 232
High-conductivity Copper Casting Alloy for Electrical Use....July 197
Amplex Division of Chrysler Corporation:
World's Record for Size of Powdered-metal Part....Sept. 207
Amplifier, General Electric Strain-gage....June 230
Analyzer, Non-destructive Material Testing by the Hypersonic....Jan. 184
Anderson Bros. Mfg. Co.:
Hydraulic Straightening Press....Sept. 22?
"Roto-Checker" for Crankshafts....Oct. 222
Anderson, M. J., Personal of....Feb. 240
Andress, John E., Personal of....Aug. 236
Andrich, Larry S., Personal of....Dec. 242
Angle-blocks, Combination Matched....May 216
Angle Checker for Form-relieved Tools, Universal Rake-....Feb. 200
Angle Dresser, Bemisine Dual-purpose....Oct. 224
Angle Dresser for Grinding Wheels, Zagar....Sept. 238
Angle, Frank C., Obituary of....Dec. 250
Angle-plate, Grinding Wheel Dresser and Lathe....Nov. 212
Angles, Method of Checking Compound. James Ahearn....Dec. 182
Anker-Holth Mfg. Co.:
Non-rotating Hydraulic Cylinders....June 226
Anschuetz, Jack F., Personal of....Aug. 240
Anti-fog Preparation for Industrial Goggle Lenses....Sept. 171
"Anti-Fog" Prevents Fog or Steam on Glass or Plastic Surfaces....Jan. 191
AO Anti-fog Preparation for Industrial Goggle Lenses....Sept. 171
Apprentice Training for Returning Servicemen....Dec. 185
Apprentice Training, Increase in....Dec. 181
Apprentices, see also Training, Education, School, Vocation
"Aquastop" Packing Liner Fabric Permits "Breathing"....Mar. 184
Arbor, Asco "Auto-Arb" Work-holding....Aug. 218
Arc Welding, see Welding
Archer, Robert S., Personal of....Mar. 240
Arcmeter Co.:
Instrument for Drawing Arcs of Large Radii....Aug. 214
Arco Co.:
New Synthetic Enamels Provide Hard Stain-proof Finish....Feb. 194
Armor Milling Machine....May 199
Armstrong, Peter V., Personal of....Jan. 212-B
Arndt, J. C.:
Modern Flat Surface Grinding Practice..May 168
Surface Grinding with Cylinder and Segmental Wheels....June 158
Surface Grinding with Periphery of Straight Wheels....July 169
Arnott, Alex S.:
Automatic Hopper-fed Knurling Fixture....Oct. 189
Arter Grinding Machine Co.:
Rotary Surface Grinding Machines....Jan. 204-B
Asco Corporation:
"Auto-Arb" Work-holding Arbor....Aug. 218
Assembling Steel Sleeves in Cylinder Blocks, Colonial Presses Developed for....Dec. 213
Assembly or Production Line, Sectionalized....May 167
Association of Roller and Silent Chain Manufacturers:
Horsepower Ratings for Silent Chain Drives....Mar. 168
Atherton, A. L., Personal of....Mar. 235
Atkinson, Robert, Obituary of....Oct. 242
Atomic Bomb Research, Some of the Peaceful Gains from....Oct. 228
Attachment for Lathes, Multi-diameter Turning....June 210
Attachments for Hager Carbide-tool Grinder, New Line of....June 216
Attachments for Lay-out, Scribing, and Measuring Work, Radii....Sept. 230
Atwood, Colonel Frank J., Personal of....Jan. 212
Austenal Laboratories, Inc.:
Working Conditions in a Machine Shop Improved by Sound-conditioning....June 188
Austin, Herbert G., Personal of....Aug. 242
"Auto-Arb" Work-holding Arbor, Asco....Aug. 218
Automatic Manufacturing Plant—Mass Production Shop of the Future. Erik Oberg....Feb. 149
Automatic Screw Machine, see also Screw Machine
Automatic Soldering, Unusual Results with. W. R. Graham....Oct. 158
Automatic Temperature Control Co., Inc.:
P7 Electronic Contactor....May 200
"Automatic Variflo" Pump, Worthington..May 201
Automatics Improved by Continuous Development Program, Potter & Johnston....June 199
Automatics, Warner & Swasey Five-spindle....Jan. 193
Automatics with Chip and Product Conveyor, Battery of Thirty-two....Oct. 171
"Autometric" Boring Machine, Milwaukee..Oct. 201
Automobile Body Parts Coated with Phosphate for Long Life....June 185
Automobile Engine for Small Cars Characterized by Light Weight....Mar. 173
Automobile Engine with Horizontal Cylinders, Cast-aluminum....Apr. 191
Automobile Industry Celebrates its Golden Jubilee....Apr. 189
Automobile Production, Hundreds of Small Strikes Hold up....July 165
Automobile Shop Wages, Industrial Workers will Pay Large Part of Increased....May 240
Automobiles per Dollar, Increased Life of..Apr. 155
Automotive Industry, Giant Bliss-Toledo Rail Press Built for....Dec. 200
Automotive Industry Stages Fifty-year Celebration....June 175
Automotive Profits Deeply Cut....June 163
Autotron Co.:
Automatic Inspection Machine....Oct. 214
Axelson Family, Four Generations of the..Feb. 248
Axelson Mfg. Co.:
Boring Machine Tool Castings for Anti-friction Bearings....Apr. 179
Ram Type Turret for Standard Lathe....June 216
"Axiaflo" Circulators, Ruthman....Sept. 224
Axle Housings, Aluminum Adopted for Truck Rear-....Aug. 186
Axtell, H. B., Personal of....Jan. 212

B

Babbitting, New Method of Preparing Bearing Shells for ..... Aug. 226
Babcock & Wilcox Tube Co.:
Nickel-steel Tubing for Low-temperature Applications ..... Jan. 191
Back-gear Shifter, Automatic. W. F. MacGlashan, Jr. ..... Aug. 193
Bailey Meter Co.:
Duplicating Attachment ..... May 208
Bails, Harry W., Obituary of ..... Oct. 242
Bakelite Corporation:
New Applications of Vinylite Plastics ..... Dec. 185
Baker Bros., Inc.:
Multiple-spindle Machines for Drilling and Reaming Rocket-shell Plates ..... Sept. 211
Baker, K. G., Personal of ..... Dec. 239
Baker Steel & Tube Co.:
Tubing Pressure Chart ..... Sept. 185
Bakewell Products Co.:
Quick-clamping Tool-holder ..... Dec. 230
Balancing Crankshafts, Ford's New Method of. Charles O. Herb ..... Mar. 156
Balancing Equipment that Records and Corrects Unbalance in Automotive Crankshafts, Gisholt ..... July 198
Balancing Machine, The Microbalancer — A Supersensitive ..... Jan. 181
Balancing Ways, Ideal ..... Sept. 230
Baldor Electric Co.:
No. 62 Improved Grinder ..... Apr. 230
Baldwin Locomotive Works:
Most Powerful Diesel-electric Locomotive in the World ..... Mar. 172
Powerful Diesel-electric Transfer Locomotive ..... Aug. 173
Baldwin Southwark Division of Baldwin Locomotive Works:
Bending and Torsion Testing Machine for Sheet Materials ..... Sept. 216
Instrument for Accurately Measuring Gas or Liquid Pressure ..... Oct. 187
Testing-machine Grip Designed to Hold Plastic Specimens ..... Oct. 209
Strain Gage Conference Held in New York ..... Oct. 230
Plastics and Metal Testing Equipment ..... Nov. 202
Ball and Roller Bearing Sizes, Standardization of ..... Apr. 159
Ball and Roller Bearings, Industry Conference on ..... Aug. 170
Ball Bearings and Spherical Bearing Rod Ends, Mono- ..... Sept. 214
Ball Bearings, Miniature Angular-contact ..... May 220
Ball Bearings, New Line of Radial ..... Feb. 212
Ball Bearings, Super-light Miniature ..... Mar. 220
Ball Bearings, Unusual Type of Narrow Large-diameter ..... Apr. 194
Ball Bearings, Waldes "Truarc" Retaining Rings for ..... Oct. 222
Ball Bushing for Linear Motion ..... July 209
"Ball Bushing" for Reciprocating Mechanisms ..... Sept. 236
Ballflex Flexible Couplings ..... Apr. 224
Ball Gaging Comparator, P & W Electrolimit ..... Mar. 207
Balls in Machine Design, Ingenious Applications of Steel ..... Oct. 168
Band Saws, Friction Cutting of Metals by. H. J. Chamberland ..... Oct. 188
Band Saws, Simplified Practice for ..... Nov. 222
Band-sawing of Hard Materials, Friction. Charles H. Wick ..... June 169
Banfield, Richard W., Personal of ..... Feb. 236
Bantam Bearings Division of Torrington Co.:
Self-aligning Spherical Roller Bearing ..... Mar. 214
Bar Stock Feed, Lipe Pneumatic ..... Mar. 214
Barber-Colman Co.:
Improved Hobbing Machine for Heavy-duty Work ..... Apr. 208
Gear-tooth Strength Calculator ..... May 242
Protecting Cutting Tools During Shipment and Storage ..... Aug. 171
Barkley, Harry W., Personal of ..... Oct. 240, Aug. 242
Barnaby, James C., Personal of ..... Feb. 238
Barnaby Mfg. & Tool Co.:
"Jam-Proof" Tap-holder ..... Mar. 210
Barnes Co., W. F. & John:
The Automatic Manufacturing Plant—Mass Production Shop of the Future ..... Feb. 149
Barnes Corporation, John S.:
Tensile-strength Testing Machine ..... Dec. 206
Fluid Power Units ..... June 220
Equalized "Roto-Blade" Pump ..... July 214
Improved Midget-size Solenoid ..... Aug. 211
Barnes, Kenneth H., Personal of ..... Aug. 236
Barnhardt, Paul, Personal of ..... May 242
Barrett Equipment Co.:
Portable Brake-drum Lathe ..... Oct. 218
Barron, E.:
Combination Die for Blanking and Drawing a Beaded Cup ..... May 183
Bart Mfg. Co.:
Internal Plating Process Makes Steel Pipe Corrosion-resistant ..... Jan. 191
Bartlett, Burke, Personal of ..... Feb. 236
Bastian, Paul J., Personal of ..... Apr. 251
Batchelar, Eugene C., Obituary of ..... Nov. 234
Bath Co., Cyril:
Forming Rings in a Universal Contour Forming Machine ..... Sept. 254
Typical Examples of Contour Forming ..... Apr. 181
Batt, William L., Personal of ..... Aug. 242
Batts, Arthur, Personal of ..... Aug. 247
Baubie, James A., Personal of ..... Oct. 240
Bauman, R. R., Personal of ..... Jan. 211-C
Bauzenberger, William B., Personal of ..... Apr. 252
Bay State Abrasive Products Co.:
Abrasive Wheel Utility Set ..... Sept. 224
Diamond Hand Hones ..... Oct. 224
Diamonds in New Improved Vitrified Bond ..... Jan. 209-C
Bayflex Abrasive Cut-off Wheels ..... Feb. 222
Beaded Cup, Combination Die for Blanking and Drawing a. E. Barron ..... May 183
Beardslee, K. R.:
Cemented Carbides Used for Other Purposes than Cutting Tools ..... Aug. 150
Bearing, Halfco Spherical ..... Dec. 230
Bearing Lubrication, Silicone Greases for High- and Low-temperature ..... Feb. 194
Bearing Metal for Automobile Engines, New Aluminum-alloy ..... July 153
Bearing, see Ball, Roller, Babbitt, Needle, etc.
Bearing Shells for Babbitting, New Method of Preparing ..... Aug. 226
Bearings, Improved Methods for Lapping Radius-formed Pivot ..... Nov. 168
Bearings Made from Cemented Carbide, High-speed ..... Nov. 148
Bearings on Special Planer Type Milling Machine, Slotting Marine ..... Apr. 151
Bearings, Rapid Milling of Propeller-shaft ..... Aug. 180
Beatty Machine & Mfg. Co.:
Hydraulic Tube-testing Press ..... Apr. 236
Beaver Tool & Engineering Corporation:
Solid Carbide Blade Face-milling Cutters ..... Apr. 232
Behr-Manning Corporation, Division of Norton Co.:
Demonstration Rooms for Grinding and Polishing ..... Mar. 240
Coated Abrasives Solve Many Reconversion Metal-finishing Problems ..... June 174
Behr Products Co.:
Boring Tool Designed to Eliminate Chatter ..... Oct. 226
Bell Aircraft Corporation:
Application of Nusite—A Specially Heat-treated High-speed Steel ..... Sept. 186
Rapid Grinding of Milling Cutters for Continuous Production ..... Feb. 179
Bellerose, Charles G., Personal of ..... Nov. 226
Bellows Co.:
Bellows-Senacon Drill Press Feed ..... Nov. 212
Belt Grinding—One of the Later Developments in the Grinding Field. W. A. Papworth ..... Dec. 155
Bemisine Dual-purpose Angle Dresser ..... Oct. 224
Benders, Automatic Cut-off Attachment for Pines ..... Mar. 206
Benders Equipped with Roller Bearings, Di-Acro ..... Sept. 232
Bending and Forming Press, Lake Erie ..... Mar. 206
Bending and Torsion Testing Machine for Sheet Materials ..... Sept. 216
Bending of Pipe and Metal Shapes. E. J. DeWitt and Harry S. Nachman:
1 ..... Apr. 141
2 ..... May 188
3 ..... June 149
4 ..... July 154
Bending Roll, Webb Initial Pinch Type ..... Nov. 220
Bending Rolls, Reed Plate ..... Feb. 199
Bendix Aviation Corporation:
"Installograph" Drawing ..... Dec. 167
Benson, Neil A., Personal of ..... Aug. 242
Benton Co.:
Opti-Locator and Datum Block ..... Dec. 228
Opti-Setter for Accurate Drilling to Lay-outs ..... July 224
Berg, L. D. T., Personal of ..... Dec. 248
Berg, Paul F.:
Comparative Study of Electric and Gas-Air Methods of Silver Brazing ..... Jan. 151
Berg, Ralph C., Personal of ..... June 240
Berg, Richard W., Personal of ..... Sept. 249
Bergenthal, V. W., Personal of ..... Feb 234
Berkeley Seam-welders ..... Jan. 209-A
Berry, Gordon J., Personal of ..... Feb. 245
Besco Tweezer Spot-welding Machine ..... Mar. 204
Best, Sidney R., Personal of ..... Mar. 236
Best Tools, Inc.:
Grinding Wheel Dresser and Lathe Angle-plate ..... Nov. 212
Betatron Makes X-ray Pictures Through Fifteen Inches of Steel ..... Jan. 180
Biggie, L. E., Personal of ..... Mar. 228
Biggs, R. W., Personal of ..... June 247
Bit-holder, Combination Contour Shaper ..... May 201
Bits, Copper "Cushioned" Tool ..... Dec. 200
Blackens Stainless Steel, Passivating Process Permanently ..... July 196
Blackwood, Thomas B., Personal of ..... Feb. 245
Blade, Carle W., Personal of ..... Nov. 226
Blades, Obtaining Full Value from Power Hacksaw. Benjamin Melnitsky ..... July 176
Blake Co., Edward:
Grinder for Sharpening Staybolt Taps ..... Dec. 210
Thin-body Chuck for Blake Tap Grinder ..... Apr. 207
Blakeslee, Clyde W., Personal of ..... Jan. 211-C
Blanked Part Simplifies Production, Redesign of ..... May 185
Blast Cleaning Equipment, Portable ..... July 206
Blind, Electronic Sound Gaging Device for Use by the ..... Sept. 189
Blind Holes with Multiple Short Broaches, Broaching ..... May 173
Blind Inspectors, Electronic Sound Gaging Device for ..... July 174
Blind Veterans, Successful Employment of ..... Aug. 156
Bliss Co., E. W.:
Giant Rail Press Built for Automotive Industry ..... Dec. 200
High-speed Perforating of Sheet Metal ..... Apr. 186
Bliss, Keith H., Personal of ..... Dec. 239
"Blitzrev" Surface Grinder Attachment ..... July 208
Blocks, Moore Set-up ..... June 217
Blocks, New Type of Brake ..... Sept. 185
Blocks, Plates, Sine Bars, and Fixtures, Commercial Standards for ..... Apr. 172
Blowpipe, Heavy-duty Machine-cutting ..... Oct. 215
"Boardmaster" Drafting Machine, Universal ..... Aug. 203
"Body Flo" Magnetic Chuck, Heavy-duty ..... July 212
Boeswetter, Willard W., Personal of ..... July 245
Boilers and Refrigerators Operated by Sun Power ..... Aug. 187
Bolte, Carl E., Personal of ..... Aug. 240
Bolts and Nuts, Simplified Practice Recommendation for ..... June 192
Bolts; Simplified Practice for Machine, Carriage, and Lag ..... Dec. 177
Bomb Nose Pistols, Zinc Die-castings for ..... Oct. 193
Booth, Paul E., Obituary of ..... Aug. 248
Bore Diameters in Long Cylinders, Instrument for Checking. Daniel E. McDonald ..... Dec. 192
Bore Gage, Small Dial Type ..... May 218
Boring a Ring-shaped Part, Special Fixture for Turning and ..... Nov. 169
Boring and Facing Attachment, Giddings & Lewis ..... Aug. 209
Boring and Facing Machine, Gemco ..... Apr. 210
Boring and Jig-grinding Machines, Inspection on Jig-. J. R. Moore ..... Apr. 160
Boring and Jig-grinding Machines Promote Interchangeability in Toolmaking Jig-. J. R. Moore ..... Mar. 163
Boring-bars and Tool-holders, Broaching Holes through. I F. Yeoman ..... Feb. 191
Boring-bars, Tri-Bit ..... Nov. 216
Boring Cast Armor on Army Tank Parts, Carbide-tipped Tools Used for ..... Feb. 163
Boring, Drilling, Reaming, and Tapping Machine, LeMaire Special Wheel-cylinder ..... Mar. 204
Boring, Drilling, Tapping, and Milling Machine, Giddings & Lewis Multi-purpose ..... Apr. 210
Boring, Facing, and Thread Milling Machine, Cross Special ..... Nov. 200
Boring Large Cylinders, Vertical Machine for ..... Aug. 20
Boring Machine, Jig, see Jig
Boring Machine, Kearney & Trecker Combination Milling and ..... Jan. 195
Boring Machine, Milwaukee "Autometric" ..... Oct. 201
Boring Machine, Root Hydraulic-feed Multiple Drilling and ..... Sept. 220
Boring Machine Tool Castings for Anti-friction Bearings ..... Apr. 179
Boring Machine, Universal Horizontal ..... Oct. 206
Boring Machines, Milling, Drilling, and ..... Jan. 199
Boring Operation, Vertical Turret Mill Equipped for Special ..... Apr. 222
Boring Shaft Holes in Gear-boxes, Methods of Locating and ..... June 195
Boring Tool Designed to Eliminate Chatter ..... Oct. 226
Borizing Problems, Set-ups That Solved Nine. C. G. Nordmark ..... Jan. 162
Bossman, M. W.:
Fixture with Overhanging Quick-acting Clamp ..... Sept. 200
"Botlube"—A Lubricant for High-speed Chain Conveyors ..... Jan. 190
Boyar-Schultz Corporation:
Knurling Tool ..... Oct. 226
Boyd, Sterling T., Personal of ..... Mar. 236
Boyer, Robert H., Personal of ..... Nov. 228
Boynton, Kenneth K., Personal of ..... Apr. 251
Bracket, Drill Jig for Swivel ..... June 189
Bradfield, Jr., George K., Personal of ..... Jan. 212
Bradford Machine Tool Co.:
"Metal Master" Electrical Tools ..... Apr. 213
Brainard, W. E.:
Aluminum Brazing ..... Sept. 143
Brake Blocks, New Type of ..... Sept. 185
Brake Control Unit for Crane Bridges, Hydraulic ..... Dec. 218
Brake, Press, see Press
Brandau, C. Rider, Personal of ..... May 232
Brazers, Westinghouse Portable ..... July 216
Brazing, Aluminum. W. E. Brainard ..... Sept. 143
Brazing Carbide Tips to Shanks, Improved Method of. William E. Newcomer ..... Oct. 192
Brazing, Comparative Study of Electric and Gas-Air Methods of Silver.. Paul F. Berg ..... Jan. 151
Bazing, Copper Furnace. Glen A. Robinson ..... Dec. 139
Brazing Equipment, Westinghouse Portable ..... Feb. 205
Brazing, Induction, see Induction
Brazing Tool Tips to Shanks by Induction Heating. T. A. Vernor and E. F. Adams ..... Dec. 178
Brewster, Arthur M., Obituary of ..... Oct. 242
Bricker, M. L., Personal of ..... Nov. 224
Bridgeport Safety Emery Wheel Co., Inc.:
BuXite Grinding Wheels ..... Sept. 218
Bridges, George, Obituary of ..... Feb. 245
Bright Dipping, Non-hazardous Solutions Developed for ..... Mar. 184
Bright-hardening, Furnace Equipment for. C. E. Peck ..... Mar. 178
Bright-hardening of Tools and Machine Parts in Controlled Atmospheres. C. E. Peck ..... Feb. 158
Brill Division of American Car & Foundry Co.:
Aircraft Manufacturing Technique Applied to Bus Building ..... Dec. 168
Brinell Testing Machine ..... Feb. 208
"Britehoning" Finishing Process ..... Aug. 194
British Tax Policy Encourages Buying Modern Equipment ..... Feb. 188
Britton, Mason, Personal of ..... Apr. 244
Broaches for Vertical and Horizontal Machines, Zagar ..... Nov. 220
Broaching, Adjustable Pull-head for Off-center ..... Mar. 218
Broaching Blind Holes with Multiple Short Broaches ..... May 173
Broaching Clutch Disk Teeth, Automatic Set-up for ..... Mar. 167
Broaching Holes through Boring-bars and Tool-holders. I. F. Yeoman ..... Feb. 191
Broaching Machine, Horizontal ..... Mar. 194
Broaching Machine, Zagar Improved Horizontal ..... Nov. 216
Broaching Machines, Colonial Flat-top ..... Feb. 203
Broaching Simplifies Machining of Valve Rocker Arms, Surface. Harry H. Gotberg ..... Sept. 176
Broaching Split-line Bearings, Hy-Mac Machines for ..... Oct. 201
Broken Taps and Cutting Hardened Steel, Disintegrators for Removing ..... Sept. 232
Bronze Welding Rods, Flux-coated ..... May 224
Brooks, C. C., Personal of ..... July 238
Brooks & Perkins:
Deep-drawing of Magnesium ..... Mar. 145
Brown, Arthur H., Personal of ..... Nov. 230
Brown Engineering Co., Leo G.:
Drill Press Filing and Slotting Attachment ..... Aug. 220
Brown, Gordon E., Personal of ..... July 240
Brown, Richard S., Personal of ..... Feb. 238
Brown & Sharpe Mfg. Co.:
Equipment for Grinding Conical Surfaces on Small Pivot Screws ..... Sept. 185

High-speed Chain Drives for Automatic Screw Machines ..... Aug. 17
Brush Development Co.:
Non-destructive Material Testing by the Hypersonic Analyzer ..... Jan. 184
Brushing, Deburring Operation Speeded 400 Per Cent by Power ..... Mar. 171
Bryant, A. G.:
How to Deal with Surplus Machine Tools Jan. 155
Bryant Chucking Grinder Co.:
Internal Grinding Machine ..... Mar. 191
Portable Thread Gage ..... Apr. 215
Bryant Machinery & Engineering Co.:
Master Model Cleereman Jig Boring Machine Mar. 198
Bryant, William H., Obituary of ..... Sept. 252
Buckendale, L. Ray, Personal of ..... Feb. 236
Bucket Carrier, Cab-operated Double- ..... Sept. 25
Buckingham, Earle:
Checking Pitch Diameters of Precision Screw Threads ..... Sept. 162
Budd Co.:
Induction Heating Applications in the Machine-building Industries ..... Aug. 181
Budwitz, Peter L.:
Gage for Checking the Height of Burrs.. Apr. 196
Buehler, Ltd.:
Abrasive Cut-off Machine ..... Mar. 220
Buffing and Grinding Machine, Hobart ..... Mar. 206
Buick Motor Division of General Motor Corporation:
Forging Aluminum Aircraft Pistons on Mechanical Presses ..... Nov. 149
Inspection Methods under Buick's New Program ..... Feb. 139
Lubricant in Piston-forging Operation Has High Flash Point ..... Feb. 174
Successful Employment of Blind Veterans Aug. 156
Building Material, Aluminum Bonded to Cellulose Core Forms New ..... July 163
Bullard Co.:
Man-Au-Trol — A Completely Automatic Machine Tool Control ..... Nov. 190
"Cut-Master" Equipped with Pendant Control ..... Mar. 202
Induction Hardening Speeds up Lead-screw Production ..... July 179
Bullard, E. C., Personal of ..... May 234
Bullard, E. P., Personal of ..... May 234
Bullock, W. E.:
Milling Cast Iron with Carbide Cutters.. Sept. 153
Bumpers, Cold-forming Oldsmobile Three-piece, Charles O. Herb ..... Aug. 141
Bunting, Charles E., Personal of ..... May 239
Burgess, Robert W., Personal of ..... Oct. 238
Burgoyne, William L., Personal of ..... Dec. 242
Burkhart, M. E., Personal of ..... June 238
Burlingame, C. Charles:
Clearing up a Misconception in the Employment of Discharged Veterans ..... Nov. 163
Burnham, Robert W., Personal of ..... Nov. 224
Burring (De-) Tools ..... Apr. 230
Burritt, Burnell O., Personal of ..... Nov. 226
Burrs, Gage for Checking the Height of, Peter L. Budwitz ..... Apr. 196
Burwell, L. K., Personal of ..... June 240
Bus Building, Aircraft Manufacturing Technique Applied to, R. B. Stubbs ..... Dec. 168
Bushing for Linear Motion, Ball ..... July 209
Bushing for Reciprocating Mechanisms, Ball Sept. 236
Bushing Stock, Centrifugally Cast Aluminum-bronze ..... Aug. 200
Bushings, Carboloy Gage ..... Feb. 220
Bushings, Inc.:
Vibro-Levelers Reduce Vibration and Simplify Leveling of Machinery ..... Dec. 187
Business Must Resist a Dictatorship of Bureaucracy ..... Jan. 182
BuXite Grinding Wheels ..... Sept. 218
Buyer's Right to Return Unsatisfactory Equipment. Leo. T. Parker ..... Oct. 194

C

Cadillac Motor Car Division of General Motors Corporation:
Improved Surface Finish of Crankshaft Bearings ..... Dec. 164
Cadmium and Zinc with One Dip, Corrosion Protection for ..... Jan. 190
Cahill, Walter F., Personal of ..... July 240
Calculating Machine, Revolutionary Electronic Apr. 190
Calculator, Gear-tooth Strength ..... May 242
Caldwell, G. A.:
Present-day Motor Drives and Other Electrical Equipment for Machine Tools.. June 164
Calipers, Quick-action Vernier ..... Apr. 232
Cam-generating Device, Rotating Disk-and-pin Mechanism for Controlling Cutter-head Slide of Automatic, Charles Colosman ..... Aug. 189
Cam Grinding on a Cylindrical Grinder, Frank Zagar ..... Feb. 180
Cam Profiles, Fixture for Milling Face- ..... Nov. 179
Cam Surfaces on a Surface Grinding Machine, Simple Method of Duplicating. Fritz L. Keller ..... July 194
Cams, Mechanite for Screw Machine ..... Dec. 195
Campbell, J. D.:
Electronic Equipment Facilitates Wire-rope Manufacture ..... Jan. 171
Campbell, Wilbur F., Personal of ..... Oct. 236
Cannon, R. H., Personal of ..... Mar. 230
Cap-screws, Parker-Kalon Ground-thread Set-screws and Size-marked ..... Mar. 218
Carbide, Blanking and Forming Dies Made from Sintered ..... Sept. 236
Carbide Cutters, Milling Cast Iron with.. Sept. 153
Carbide Die Increases Production of Motor Laminations ..... Oct. 232
Carbide Die & Mold Co.:
High Production with Carbide Nib Molds Oct. 230
Carbide, Disintegrator for Removing Broken Taps and Drilling Tungsten ..... Apr. 236
Carbide Gage-blocks, Fonda ..... Nov. 204
Carbide, High-speed Bearings Made from Cemented ..... Nov. 148
Carbide Lathe-center Tip, Flaring Tubes with Jan. 150
Carbide Milling Cutter Data Calculating Chart Apr. 173
Carbide Nib Molds, High Production with Oct. 230
Carbide Thread Plug Gages, Tungsten- ..... Nov. 200
Carbide-tipped Core-drills ..... Oct. 209
Carbide-tipped Cutters, Milling T-slots with Jan. 187
Carbide-tipped Tools Used for Boring Cast Armor on Army Tank Parts ..... Feb. 163
Carbide Tips, Solid Reamers with Flute-long Feb. 205
Carbide Tips to Shanks, Improved Method of Brazing, William E. Newcomer ..... Oct. 192
Carbide Tips to Tools, Induction Brazing of Apr. 177
Carbide-tool Grinder, Hager ..... Feb. 200
Carbide Tools, Honing Wheel Facilitates Finish-sharpening of ..... June 176
Carbide Tools Keeps Shop Floors Smooth, Unusual Application of ..... Feb. 186
Carbide Tools, When Coolants Should be Used with ..... Aug. 149
Carbide Used for Tool Grinder Ways ..... Dec. 160
Carbides Improves High-speed Steels, Even Distribution of Free ..... Aug. 198
Carbides in Hardness Testing, Application of Cemented ..... Jan. 168
Carbides Used for Machining Cast Iron, Steel-cutting Grades of ..... Jan. 210
Carbides Used for Other Purposes than Cutting Tools, Cemented. K. R. Beardslee ..... Aug. 150
Carbo "C" and Carbo "N" Rust Inhibitors for Inside Storage Protection ..... Dec. 197
Carboloy Blades, Face Milling Cutter with Solid ..... May 195
Carboloy Cemented-carbide Tool Resists Severe Impact on Maintenance Job ..... June 181
Carboloy Cemented Carbide Used for Machining Cast Iron ..... Jan. 210
Carboloy Company, Inc.:
High-speed Bearings Made from Cemented Carbide ..... Nov. 148
Carbide Used for Tool Grinder Ways ..... Dec. 160
Plug- and Ring-gage Bushings ..... Feb. 220
Threading Tools ..... May 218
German Tank Armor Pierced by Carboloy Core of Projectile ..... June 198
When Coolants Should be Used with Carbide Tools ..... Aug. 149
Cemented Carbides Used for Other Purposes than Cutting Tools ..... Aug. 150
Carboloy, Die Life Lengthened by the Use of Apr. 184
Carboloy Pins Reduce Maintenance of Knurling Tools ..... May 167
Carboloy-tool Rotary Floor Scraper ..... Feb. 186
Carbozite Corporation:
Rust Inhibitors Developed for Inside Storage Protection ..... Dec. 197
Carburizing Process Simplifies Salt Removal, Liquid ..... Apr. 201
Carlson, A. L., Personal of ..... Aug. 240
Carlson, Harold C. R., Personal of ..... May 239
Carlstein, Eric S., Personal of ..... Oct. 234
Carlyle Johnson Machine Co., see Johnson Machine Co., Carlyle
Carnegie-Illinois Steel Corporation:
Stainless Heat-treatable Steel Now Available for General Use ..... Feb. 194
Carpenter Steel Co.:
Flexible Stainless-steel Hose ..... Oct. 170
Stainless-steel Tubing Data Chart ..... Apr. 199
Vega Die Steel that Hardens in Heavy Sections ..... Apr. 200
Carriage, Oxweld-Unionmelt Machine ..... Jan. 201
Carrier, Cab-operated Double-bucket .... Sept. 230
Cartridges for Blind-hole Tapping, Tap- .... Oct. 220
Cast-iron Castings, High-strength ..... June 192
Cast Iron for High-strength Clutch Plate Aug. 194
Cast Iron, Machine-tool ..... Dec. 195
Cast Iron, Steel-cutting Grades of Carbides Used for Machining ..... Jan. 210
Casting Alloy for Electrical Use, High-conductivity Copper ..... July 197
Casting Machine, "Centri-Meco" Centrifugal Sept. 214
Casting on a Mass Production Basis, Precision. C. O. Herb ..... May 149
Castings for Anti-friction Bearings, Boring Machine Tool ..... Apr. 179
Castings for Use at Extremely Low Temperatures, High Impact Values of Steel ..... June 190
Castings, High-strength ..... June 192
Castings, New Method of Salvaging ..... Sept. 161
Castings, New Type of Thermit for Producing Steel ..... Jan. 191
Castings, Plastic Substitute for Tung Oil in Sealing Magnesium ..... Nov. 174
Castle Films, Inc.:
United States Government Educational Films May 224
"Castweld" Set Industrial Diamonds ..... Sept. 240
Cemented Carbide, see Carbide
Center, J & S Self-oiling Lathe ..... May 201
Center-lapping Tool, Reich ..... May 222
Center-wing Bottlenecks, Machine Grouping Eliminated ..... Oct. 162
Centers, "Star" Live ..... Feb. 220
Centers with Interchangeable Points, Empire Live ..... Apr. 224
Centering and Measuring Operations, Opti-Locator and Datum Block for ..... Dec. 228
Centering Device Used in Positioning Work Drilled in Lathe ..... June 196
Centering Machine, Pratt & Whitney Automatic ..... Nov. 196
Centering Machine, Shaft Facing and ..... Apr. 204
"Centering-Throat" Chasers, Landis ..... July 212
Centerless Grinder, Automatic Magazine-feed Attachment for ..... Oct. 185
Centerless Grinding Machine, Lidkoping.. Feb. 203
Centerless Lapping Machine ..... June 222
Centerless Thread Grinding Machine, Landis June 200
Centrifugal Machine & Engineering Co.:
"Centri-Meco" Centrifugal Casting Machine Sept. 214
"Centri-Meco" Centrifugal Casting Machine Sept. 214
"Centri-Power" Coolant Filter, Honan-Crane Feb. 216
Ceramic Material Has Unusual Dimensional Stability, New ..... Dec. 197
Chafee, John S., Personal of ..... Feb. 238
Chain Drives for Automatic Screw Machines, High-speed ..... Aug. 172
Chain Drives, Horsepower Ratings for Silent Mar. 168
Chamberland, H. J.:
Friction Cutting of Metals by Band Saws Oct. 188
"Champ" High-frequency Heating Unit .... May 196
Chance Vought Aircraft Division of United Aircraft Corporation:
New Featherweight Structural Material Developed in Aircraft Field ..... Apr. 200
Chart, Carbide Milling Cutter Data Calculating Apr. 173
Chart Improves Truck Maintenance, Safe Loading ..... June 168
Chart, Stainless-steel Tubing Data ..... Apr. 199
Chartrand, F.:
Molding Presses for the Plastics Industries Sept. 172
Chasers, Landis "Centering-Throat" ..... July 212
Checker for Form-relieved Tools, Universal Rake-angle ..... Feb. 200
Checking Bore Diameters in Long Cylinders, Instrument for, Daniel E. McDonald.. Dec. 192
Checking Crankshafts, "Roto-Checker" Developed for ..... Oct. 222
Checking Employes' Vision ..... Apr. 199
Checking Machine, Sheffield Automatic Piston-ring ..... Nov. 206
Checking Pitch Diameters of Precision Screw Threads. Earle Buckingham ..... Sept. 162
Chemical Elements in Materials, Instrument that Records Presence of ..... Aug. 187
Chemical Treatment of Highly Finished Metal Surfaces ..... July 166
Chern, V. A., Personal of ..... Jan. 212
Cherry Rivet Co.:
Rivets and Pneumatic-hydraulic Rivet Gun Jan. 209-A
"Umbrella Plug" for Covering Heads of Hollow Rivets ..... Feb. 226
Chesterman Large-sized Height Gage ..... Apr. 217
Chicago Drillet Corporation:
"Quadrill" Equipped with Indexing Device Dec. 228
Drillet Box Jigs ..... Mar. 210
Chicago-Latrobe Twist Drill Works:
Stub Screw Machine Drills ..... May 196
Chicago Metal Hose Corporation:
Flexible Conduit for Machine Tool Installations ..... Aug. 222
Chicago Tool & Engineering Co.:
Under-water Oxygen Cutting Equipment.. Oct. 228
China, Machine Tool Manufacturers to Aid in Industrialization of ..... Nov. 178
Chip-breaker Attachment for Drilling Machine May 201
Chip Separator for Screw Machine Products, McKenzie ..... July 205
Chips from Milling Machines, Cleaner Products Obtained by Exhausting Fine ..... Aug. 172
Chovanec, William J., Personal of ..... Nov. 228
Christian, Frank T., Personal of ..... Jan. 212-B
Christiansen, C. W.:
Grinding Lathe Tools to Eliminate Chatter May 174
Chrome-vanadium Steel with High Strength and Toughness, New "Elastuf" ..... Jan. 190
Chronograph Provides Fast Method of Timing in Ballistic Tests, Counter ..... July 227
Chuck, Erickson Collet Type Speed ..... Jan. 209-C
Chuck for Blake Tap Grinder, Thin-body.. Apr. 207
Chuck for Threading Hypoid Gears on Landmaco Machine, Special ..... Nov. 215
Chuck, Heavy-duty "Body Flo" Magnetic. July 212
Chuck, Redmer Air-operated Collet ..... Mar. 193
Chuck, Turner Keyless Drill ..... Nov. 222
Chuck with All-steel Top Plate, Hanchett Magnetic ..... Nov. 208
Chucks and Tapping Attachments, Wahlstrom Automatic Drill ..... Feb. 210
Chucks, Jacobs Rubber-Flex Drill ..... Nov. 218
Chucks, Woodworth Air-operated Diaphragm Dec. 226
Chucking Machine, see also Automatic "Chuck-Matic," Acme-Gridley Single-spindle May 193
Cincinnati Bickford Tool Co.:
"Super Service" Upright Drilling Machine Apr. 211
Cincinnati Grinders Incorporated:
Hydraulic Universal Grinding Machines Equipped with New Headstock ..... Feb. 198
Precision Center-type Plain Grinding Machines ..... Apr. 212
Cincinnati Milling Machine Co.:
Milling Cast Iron with Carbide Cutters Sept. 153
Initial Contact of Milling Cutter and Workpiece ..... Oct. 149
Radius Grinding Attachment ..... Apr. 207
Monoset Cutter and Tool Grinding Machine May 194
Plain and Duplex Hydromatic Milling Machines ..... June 205
Improved Milling Machines ..... Aug. 201
Circular Saw, Parlec Combination Sander, Grinder, and ..... Apr. 214
Circulators, Ruthman "Axiaflo" .... Sept. 224
Clad Steels by Rolling, Production of, Charles H. Wick ..... July 158
Clamer, Dr. Guilliam H., Personal of ..... May 240
Clamp, Fixture with Overhanging Quick-acting, M. W. Bossman ..... Sept. 200
Clamp, Woodworth "Cone-Lok" Unit and Fixture Clamp ..... Feb. 216
"Clamped-On-Tip" Tools, Kennametal .... Aug. 222
Clare, Lewis, Personal of ..... Dec. 244
Clarifier, Honan-Crane Oil ..... Nov. 216

Clark Co., Robert H.:
Adjustable Counterbores ..... Dec. 222
Clark Equipment Co.:
Motion Picture for Engineering Classes ..... June 151
Clark, James A., Personal of..... June 247
Clark, Lieutenant Franklin P., Personal of ..... Nov. 228
Clark, R. H.:
Standardization of Electrical Equipment for Machine Tools ..... Jan. 176
Clarke, N. J., Personal of..... Sept. 246
Clayton Formula? Just What is the..... Feb. 174
Cleaner Developed for Cement and Tile Floors, Heavy-duty Floor ..... June 198
Cleaner for Use in Power Spray Washers, Emulsion Type ..... Mar. 184
Cleaner Suitable for Use in Any Type of Water ..... Apr. 200
Cleaners and Coolant Filters, Honan-Crane Sump ..... Feb. 216
Cleaning Compound for Flexible Abrasives and Metal Files ..... Aug. 198
Cleaning Equipment, Portable Blast..... July 206
Cleaning Machine, Automatic Drilling, Etching, and ..... Mar. 211
Cleaning Machinery for Reconversion, Use of Solvents in, Mable Foy..... Dec. 165
Cleaning Precision Bearings and Instrument Parts, Safety Solvents for ..... Mar. 185
Cleaning Process that Facilitates Bonding of Meehanite to Babbitt ..... July 196
Cleaning Systems, Gray-Mills ..... Jan. 205-A
Cleaning Unit, Oakite-Vapor ..... Jan. 199
Cleaning Unit, Portable Steam ..... June 177
Cleavenger, W. D., Personal of..... Apr. 244
Cleereman Machine Tool Co.:
Master Model Jig Boring Machine..... Mar. 198
Clements, Albert, Personal of..... Aug. 240
Cleveland Automatic Machine Co.:
Hydraulic Die-casting Machine ..... Mar. 195
Cleveland Crane & Engineering Co.:
Power-driven Metal-cutting Shears..... Feb. 197
Cleveland Indexing Head ..... July 218
Cleveland Tapping Machine Co.:
Horizontal Drilling and Tapping Machine ..... Jan. 198
Cleveland Tramrail Division of Cleveland Crane & Engineering Co.:
Cab-operated Double-bucket Carrier .... Sept. 230
Cleveland Twist Drill Co.:
Speeds, Feeds, and Lubricants for Reaming ..... Aug. 157
Cline, Frank C., Personal of..... Oct. 236
Clinton Machine Co.:
Thomas "Metal Master" for Welding and Similar Work ..... Aug. 207
Cloth Resists Temperature Change, Flexible Diaphragm ..... July 197
Clowes, Lloyd R., Personal of..... Sept. 249
Clutch Disk Teeth, Automatic Set-up for Broaching ..... Mar. 167
Clutch, "Formsprag" Over-running..... Sept. 238
Clutch Plate, Material for High-strength..Aug. 194
Clutch with Automatic Overload Release, Safety ..... Jan. 198
Clutches, Salsbury Automatic ..... Jan. 209-A
Coated Stoody 1 and Coated Stoody 6 Hard-facing Alloys ..... Dec. 197
Coating Equipment with Improved Features, New Electrode ..... Sept. 189
Coating for Plating-rack Protection, Thermoplastic Air-drying ..... Aug. 198
Coating for Protecting Metal Products, Plastic ..... Aug. 199
Coating Materials Provide Moisture-vapor Protection, Two Saran ..... Aug. 200
Coating on Highly Finished Metal Surfaces, Chemical ..... July 166
Code, Safety Color ..... Sept. 250
Cossdill, S. A., Personal of ..... May 232
Coil for Localized Hardening, Induction Heating ..... Apr. 213
Coil with Interchangeable Inserts, Master Induction Heating ..... Nov. 215
Cold-bending of Pipe and Metal Shapes. E. J. DeWitt and Harry S. Nachman..... Apr. 141
Cold-forming Oldsmobile Three-piece Bumpers. Charles O. Herb ..... Aug. 141
Cold-treatment, "Flash Freeze" Unit for Industrial ..... Apr. 217
Cold-treatment to Steel, Some Applications of. Stewart M. DePoy ..... Sept. 165
Collet for Indexing Table Type Machine Tools, Zagar ..... Oct. 212
Collet-holding Fixture, Hardinge ..... Mar. 216
Collet, Mead Air ..... Nov. 215
Collet-operating Mechanism for Screw Machines, Spindle-control and. A. W. Jansson....July 189
Collins, James F., Personal of..... Feb. 238
Colonial Broach Co.:
Surface Broaching Simplifies Machining of Valve Rocker Arms ..... Sept. 176
Presses Developed for Assembling Steel Sleeves in Cylinder Blocks..... Dec. 213
Flat-top Broaching Machines ..... Feb. 203
Press Equipped for Sizing and Finishing Bores of Shock Absorbers ..... Feb. 213
Automatic Set-up for Broaching Clutch Disk Teeth ..... Mar. 167
Adjustable Pull-head for Off-center Broaching ..... Mar. 218
Broaching Blind Holes with Multiple Short Broaches ..... May 173
Color Code, Safety ..... Sept. 250
"Color Parkerizing" Increases Corrosion Resistance of Iron and Steel..... July 197
Combination Machine, see also Tool-room Machine
Commander Mfg. Co.:
"Multi-Drill" Attachment ..... Oct. 208
Commentry Industries, Inc.:
Tavannes Single-spindle Automatic Screw Machines ..... Apr. 220
Communication Measurements Laboratory:
Portable Stroboscope ..... July 207
Comparator, Comtor Surface Smoothness..Dec. 220
Comparator, Dial ..... June 213
Comparator for Helical Gears, Michigan Sine-line Lead ..... July 202
Comparator Gage, Moore Pneumatic ..... Oct. 220
Comparator, Optical Contour ..... Apr. 217
Comparator, P & W Electrolimit Ball Gaging ..... Mar. 207
Comparator, Pratt & Whitney Electrolimit External ..... Dec. 224
Comparator with Ball-sorting Attachment, Pratt & Whitney Electrolimit..... Feb. 218
Comparators, Improved Air-O-Limit..... Mar. 214
Comparators, New Scribing Plate for Optical ..... Aug. 226
Compar-Instrument Co.:
The Comparoscope—An Optical Instrument for Evaluating Surface Finishes..... Sept. 191
Comparoscope—An Optical Instrument for Evaluating Surface Finishes ..... Sept. 191
Compound Angles, Method of Checking. James Ahearn ..... Dec. 182
Compound for Removing Flux and Welding Scale from Metal ..... Nov. 175
Compound for Stamping Operations, Improved Drawing ..... Jan. 190
Compound, General Electric Arc-welding ..... Jan. 208-B
Compound Makes Foundry Molds Fire-resistant ..... Sept. 207
Compound, Michigan Abrasive Lapping....Oct. 214
Compounds for Machining Aluminum Alloys, Cutting ..... June 168
Compounds for Press Work, Selecting Drawing. James McElgin ..... Apr. 157
Comtor Co.:
Surface Smoothness Comparator ..... Dec. 220
Conduit for Machine Tool Installations, Flexible ..... Aug. 222
"Cone-Lok" Unit and Fixture Clamp, Woodworth ..... Feb. 216
Conical Surfaces on Small Pivot Screws, Equipment for Grinding ..... Sept. 185
Conical Tool Co.:
Tapered Cutting Tool of End-mill Type ..... May 220
Conn, Paul, Personal of ..... Mar. 228
Conrad, Harry E., Personal of..... Jan. 211-C
Conroy, III, John F., Personal of..... June 242
Consolidated Machine Tool Corporation:
Newton Radius-link Grinding Machine..Jan. 194
A Heavy Job for Carbide-tipped Tools..Feb. 163
Consolidated Vultee Aircraft Corporation:
Aluminum Brazing ..... Sept. 143
New Lubricant Lengthens Drill Life by Reducing Breakage ..... Nov. 175
Contact of Milling Cutter and Work-piece, Initial. Dr M. Kronenberg ..... Oct. 149
Contacts, "Gibsilov" Electrical ..... Feb. 197
Contactor, ATC Electronic ..... May 200
Contactor, Westinghouse Magnetic..... Jan. 208-B
Contour Comparator, Optical ..... Apr. 217
Contour Forming, Typical Examples of. Cyril J. Bath ..... Apr. 181
Contours and Profiles, Pantograph Mechanisms Used in Machining ..... Nov. 171
Contracts He has Signed? When is a Purchasing Agent Personally Liable for. Leo T. Parker ..... Dec. 195
Control and Valve for Air-operated Equipment, Redmer Foot ..... Dec. 226
Control Boards, Plastic "Glass" Panels for ..... Oct. 232
Control, Bullard Man-Au-Trol—A Completely Automatic Machine Tool ..... Nov. 190
Control Makes Bench Welder a Precise Production Tool, Electronic. L. J. Gottschalk, Jr. ..... Sept. 168
Control, Reproducing from Patterns or Templets by Electronic..... Jan. 175
Control Speeds Welding, Automatic Positioning ..... Nov. 176
Control, Sperry Miniature Hydraulic..... May 216
Control Unit for Crane Bridges, Hydraulic Brake..... Dec. 218
Control Unit, "Ultra-Speed" Welder..... Mar. 197
Control Widens Scope of Oxy-acetylene Cutting Machines, Electronic ..... Jan. 189
Converter Changes a Lathe into an All-around Machine Shop, A Lathe..... Mar. 176
Conveyor, Battery of Thirty-two Automatics with Chip and Product..... Oct. 171
Conveyors, Lubricant Developed for High-speed Chain..... Jan. 190
Conveyors "Packaged" Line of Roller..... May 222
Conway, Bert, Personal of..... Mar. 230
"Coolant Klean" Filter..... Dec. 216
Coolant System, Portable Central..... Jan. 175
Coolants Should be Used with Carbide Tools, When ..... Aug. 149
Cooley Electric Mfg. Corporation:
Small-size Heat-treating Furnaces..... May 206
Cooper-Bessemer Corporation:
Carbide Milling Cutter Data Calculating Chart..... Apr. 173
Turning and Cutting-off Tool-holders..... May 210
Cooperation is Essential to Engineering Progress, Industrial ..... Mar. 174
Copper Alloy Provides Unusual Strength and Hardness ..... Apr. 201
Copper Casting Alloy for Electrical Use, High-conductivity ..... July 197
Copper Furnace Brazing. Glen A. Robinson ..... Dec. 139
Copper Rod Saves Machining Time, New Free-cutting..... Dec. 196
Cordo Chemical Corporation:
Synthetic Plastic Adhesive for Laminated Construction..... Dec. 197
Correction—Fonda Gage-blocks..... Jan. 209-C
Correction—"Grip-Slide" Threading and Tapping Tool..... July 224
Correction—Logan "Air-Draulic" Cylinders ..... June 191
Corrigan, Charles A., Obituary of..... July 250
Corrosion, Micrcloid Provides Protective Coating Against ..... Nov. 175
Corrosion Protection for Cadmium and Zinc with One Dip..... Jan. 190
Corrosion Protection for Metal Products, "Dip-wrap" Compound Provides..... Jan. 191
Corrosion Resistance of Iron and Steel, Color Parkerizing Increases ..... July 197
Corrosion-resisting Coating for Aluminum and Aluminum Alloys ..... Dec. 187
Cosa Corporation:
"Sip" Profile Projector..... Dec. 212
"Sip" Profile Projector and Universal Measuring Apparatus ..... June 201
New Sip High-precision Jig Borer..... July 202
Profile Grinding Machine..... Aug. 204
Coslow, Carl W., Personal of..... Aug. 236
Cost of Manufacture, The Designer Must Consider..... May 180
Cost of Production, Needless Accuracy May Add Greatly to..... Aug. 188
Costs to a Minimum, Governing Factors in Holding Machining..... Aug. 185
Costello, Harry, Personal of..... July 245
Counter Chronograph Provides Fast Method of Timing in Ballistic Tests..... July 227
Counterbores, Clark Adjustable ..... Dec. 222
Counterboring, Drilling, Spot-facing, and Tapping, "Hy-Mac" Special Machine For ..... July 204
Counterboring Obstructed Holes. E. E. Forstrom..... Nov. 182
"Counting-Guard" for Power Presses, Searjeant ..... Jan. 205-B
Coupling, Lovejoy Double-Flex..... July 222
Couplings, Ballflex Flexible ..... Apr. 224
Course in Industrial Vision..... Oct. 183
Course in Mechanics, Correspondence..... June 168
Course in Quality Control By Statistical Methods..... Oct. 161
Courses, Veterans' Refresher..... Oct. 172
Covel Mfg. Co.:
Excel Universal Cutter and Tool Grinding Machine ..... Aug. 205
Cowan, Harry W., Obituary of..... Dec. 250
Craig, Harvey A., Personal of..... Mar. 228
Crane Bridges, Hydraulic Brake Control Unit for..... Dec. 218
Crane, E. V., Personal of..... Dec. 244
Crankpin Grinding Machine for Heavy Diesel-engine Crankshafts, Landis Hydraulic....Jan. 197
Crankpin Turning Lathe, Wickes Automatic Multiple ..... June 213
Crankshaft Bearings Improved at Cadillac, Surface Finish of..... Dec. 164
Crankshaft Lathes, LeBlond Automatic....Apr. 202
Crankshaft Threading Rate, Special Taps Greatly Increase..... July 226
Crankshaft Turning Lathe, Wickes Automatic ..... Mar. 196
Crankshafts, Anderson "Roto-Checker" for..Oct. 222
Crankshafts, Ford's New Method of Balancing. Charles O. Herb ..... Mar. 156
Crawford, David, Personal of..... Apr. 251
Creamer, Robert E., Personal of..... Feb. 238
Crimping Tool, Convenient and Ingenious..July 168
Critton, N. H., Personal of..... Aug. 242
Crosley Motors, Inc.:
Automobile Engine for Small Cars Characterized by Light Weight..... Mar. 173
Cross Co.:
Special Boring, Facing, and Thread Milling Machine..... Nov. 200
Shaft Facing and Centering Machine..Apr. 204
Rotary Thread-milling Machine ..... June 204
Cross, E. G., Personal of ..... Oct. 238
Crozier Machine Tool Co.:
Vacuum-grip Speed Lathe..... July 218
Crush-dressing of Grinding Wheels, New Applications of. Carl Linxweiler..... Jan. 143
Crush Form Contour Grinding Machine, Thompson..... Sept. 226
Crush-forming of Grinding Wheels, Using Diamonds for the. Harry L. Strauss, Jr. ..... Jan. 179
Cummings, Charles E., Obituary of..... July 250
Cunico Permanent-magnet Material..... July 236
Cunife Permanent-magnet Material..... July 236
Cuno Engineering Corporation:
Filter for Grinder Coolant..... Dec. 216
Cup, Combination Die for Blanking and Drawing a Beaded. E. Barron..... May 183
Cupro-Arc Electrode ..... Jan. 200
Curtis, Russell G., Personal of..... Nov. 226
Curtiss-Wright Corporation:
Milling Cutter Saves Ten Thousand Man-hours a Year..... Oct. 166
Giant Aircraft Propeller with Hollow Steel Blades ..... Aug. 226
"Cushioned" Blades, Milling Cutter with..Feb. 213
Custer, Clarence W., Personal of..... June 247
"Cut Master" Vertical Turret Lathe with Pendant Control, Bullard..... Mar. 202
Cut-off Attachment for Pines Benders, Automatic ..... Mar. 206
Cut-off Machine, Buehler Abrasive..... Mar. 220
Cutter and Work-piece, Initial Contact of Milling. Dr. M. Kronenberg..... Oct. 149
Cutter Data Calculating Chart, Carbide Milling..... Apr. 173
Cutter Designed to Lessen Cutting Stresses, Eccentric Milling ..... Sept. 204
Cutter Saves Ten Thousand Man-hours a Year, Milling..... Oct. 166
Cutter with Adjustable Blades, Helical. Charles F. Smith ..... July 193
Cutter with "Cushioned" Blades, Milling Feb. 213
Cutter with Interchangeable Carbide Blades, Wendt-Sonis Milling ..... Aug. 224
Cutter with Solid Carboloy Blades, Face Milling ..... May 195
Cutter, Wyco Heavy-duty Hole and Washer ..... July 222
Cutters, Beaver Solid Carbide Blade Face-Milling..... Apr. 232
Cutters for Continuous Production, Rapid Grinding of Milling..... Feb. 179
Cutters for Face-milling Steels, "Vibra-Cushioned" Carbide ..... Apr. 225
Cutters, Kennametal Universal Face-milling ..... Mar. 218
Cutters, Milling Cast Iron with Carbide....Sept. 153
Cutters with Cushioned Blades, Performance of Milling..... Mar. 186
Cutting Compound, Oil, see Compound, Oil
Cutting Electrode, Ellwood Improved..... Sept. 222
Cutting Equipment, Under-water Oxygen....Oct. 228

"Curved Clearance" Reamer and Cutter Grinding Machine .....Dec. 201
Cutting, Flame-, see Flame-cutting
Cutting Fluids, Meeting of Committee on..Dec. 194
Cutting Fluids, The Problem of.....Dec. 194
Cutting Hardened Steel, Disintegrators for Removing Broken Taps and.....Sept. 232
Cutting Machine, Oxweld Shape-.....May 196
Cutting Machines, Electronic Control Widens Scope of Oxy-acetylene.....Jan. 189
Cutting-off and Sawing Machines, Motch & Merryweather .....May 197
Cutting-off Tool-holders, Cooper-Bessemer Turning and .....May 210
Cutting Operation, Eliminating Distortion in Torch.....Aug. 185
Cutting Tool Manufacturers Association:
New Officers Elected .....Feb. 163
Cylinder Sleeve Production Embodies Unique Engineering Ideas, Ford. Charles O. Herb July 139
Cylinders, Anker-Holth Non-rotating Hydraulic June 226
Cylinders, Logan "Air-Draulic"..May 212, June 191
Cylinders, Logan "Rotocast" Hydraulic....Dec. 224
Cylinders, Modernair Cushion Type.....Aug. 222
Cylinders, Standardized .....May 224
Cylinders, Vertical Machine for Boring Large Aug. 208
Czarnecki, Sigmund A., Personal of.....Apr. 244

D

D. & S. Model Co.:
High-speed Surface Grinder Attachment July 208
Dade Brothers, Inc.:
Repair Parts Effectively Protected by Plastic Skin ..... Nov. 174
Dahlstrom Mfg. Co.:
Fixture Designed to Reduce Tap Breakage June 204
Daines, Lee A., Obituary of ..... May 242
Dake Engine Co.:
Punch Press Guard .....May 218
Electric-hydraulic Press ..... July 220
Daniels Tool Co., Inc., N. J.:
Precision Reamers ..... July 216
Dannehower, Gilbert L., Personal of.....Feb. 238
Datum Block, Opti-Locator and ..... Dec. 228
Davey Compressor Co.:
Portable Machine Shop ..... Apr. 185
Davies, Colonel Clarence E., Personal of..Feb. 238
Davies, Lew C., Personal of.....July 238
Davies, R. H., Personal of ..... Apr. 251
Davies, Robert H., Personal of.....July 245
Davis, John M., Obituary of ..... Feb. 245
Davis & Murphy:
Universal Air-operated Spot-welder .... Mar. 207
Davis & Thompson Co.:
Roto-Matic Milling Machine ..... Jan. 198
Four-station Indexing Machine for Milling, Drilling, and Tapping Motor Frames..Apr. 205
Dayton Rogers Mfg. Co., see Rogers Mfg. Co., Dayton
DCMT Sales Corporation:
Die-casting Machine for Small-lot Production ..... Apr. 211
Dearborn, Inc., Howard:
Tool Adjustment Block ..... July 218
Deburring Operation Speeded 400 Per Cent by Power Brushing ..... Mar. 171
"Decimatic" Indicators for Checking Close Tolerances ..... May 212
Deflection Pick-up Unit, Precision Pressure and ..... Mar. 211
de Luca, Edward, Personal of ..... Oct. 240
Demagnetizer for Small-diameter Tools, Grayhill ..... Jan. 195
Denison Engineering Co.:
Packaged Hydraulic Power Assemblies..Feb. 202
Shuttle Feed for "Multipress"..... May 200
Dennis, Harry A., Personal of ..... Jan. 212-B
DePoy, Stewart M.:
Some Applications of Sub-zero Treatment to Steel ..... Sept. 165
Deppeler, J. H., Personal of ..... Sept. 244
Descaling Metals, Sodium-hydride Process for Feb. 187
"Desegatizing" Process Improves High-speed Steel ..... Aug. 198
Design, Ingenious Applications of Steel Balls in Machine ..... Oct. 168
Designs, Vibration Test Table Used to Shake Out Faults of New ..... Nov. 167
Designer Must Consider Cost of Manufacture, The ..... May 180
Designer Should Know About Welded Machinery Parts, What the. George L. Snyder:
1 ..... Jan. 157
2 ..... Feb. 167
Designers for Industry, Inc.:
Booklet on Employment Opportunities in Industrial Design ..... Oct. 167
Despatch Oven Co.:
Furnace for Preheating Magnesium Sheets Jan. 208-B
Detroit Tap & Tool Co.:
Improved Tap-conditioner ..... Sept. 228
Universal Rake-angle Checker for Form-relieved Tools ..... Feb. 200
Threaded Spring Hangers Tapped in Eight Seconds ..... Apr. 165
Special Taps Greatly Increase Crankshaft Threading Rate ..... July 226
Deuker, H. W., Personal of ..... Mar. 236
Developing Machine, Pease Printing and Apr. 215
DeVlieg Machine Co.:
Combination Matched Angle-blocks .... May 216
DeWitt, E. J.:
Cold-bending of Pipe and Metal Shapes Apr. 141
Tools for Use in Bending Machines.....May 188
The Hydraulic Circuit in Bending Machines June 149
Designing Work for Bending ..... July 154
Di-Acro Benders Equipped with Roller Bearings ..... Sept. 232
Dial Indicator, see Indicator
Diamond Dressing Tool, Sunnen ..... Aug. 218
Diamond Hand Hones, Bay State.....Oct. 224
Diamond-impregnated Hand Hones, Half-round ..... Sept. 234
Diamond Machine Tool Co.:
Power Punch Presses ..... May 206
M-30 Milling Machine ..... Aug. 202
Diamond "R" Files and Hones ..... Feb. 224
Diamond Tools, Equipment Designed to Facilitate the Use of. Dr. G. Schlesinger and Dr. D. F. Galloway ..... June 179
Diamonds, "Castweld" Set Industrial.....Sept. 240
Diamonds for the Crush-forming of Grinding Wheels, Using. Harry L. Strauss, Jr...Jan. 179
Diamonds in New Improved Vitrified Bond Jan. 209-C
Diamonds, Powdered Metal for Setting....Jan. 201
Diaphragm Cloth Resists Temperature Change, Flexible ..... July 197
Dictatorship of Bureaucracy, Business Must Resist a ..... Jan. 182
Die-casting Machine, Cleveland ..... Mar. 195
Die-casting Machine Designed for Automatic Operation ..... Nov. 208
Die-casting Machine for Small-lot Production Apr. 211
Die-casting Machine, Harvill Automatic Hydraulic ..... Dec. 199
Die-casting Machine, Huge High-pressure Sept. 216
Die-casting Machine, Hydropress ..... July 203
Die-casting Machines, Harvill ..... Oct. 200
Die-casting Machines, Harvill Heavy-duty Jan. 205-B
Die-casting Machines, H-P-M High-pressure June 203
Die-casting Machines, Lester-Phoenix Improved Mar. 193
Die-casting, Prehardened Die Steel for Use in Zinc-alloy ..... June 158
Die-castings for Bomb Nose Pistols, Zinc..Oct. 193
Die Cushions, Dayton Rogers Heavy-duty Pneumatic ..... Oct. 216
Die Designed to Save Stock by Drawing Metal from Around Inner Blanked Hole. Wallace C. Mills ..... Sept. 202
Die Equipped with Three Tool Bits for Notching Flanged Shell. John P. Junk.....Nov. 181
Die-filing Machine, Precision ..... Feb. 204
Die for Blanking and Drawing a Beaded Cup, Combination. E. Barron ..... May 183
Die for Forming Extruded Rivet in Sheet-metal Plate. Wallace C. Mills.....Dec. 191
Die for Forming Irregular-shaped Spring. L. Kasper ..... Jan. 185
Die Forgings, Research on Closed-impression July 165
Die-head, Landex Improved ..... Oct. 222
Die-head of Improved Design, Geometric..July 216
Die-heads and Ground-thread Flat Rolling Dies, Jones & Lamson Automatic Self-Opening.....June 208
Die-heads, Lanco Hardened and Ground....Apr. 213
Die-heads, Three New Insert-chaser.....Jan. 208
Die Increases Production of Motor Laminations, Carbide ..... Oct. 232
Die Life Lengthened by the Use of Carboloy Apr. 184
Die, see also Drawing, Punch, Threading
Die Sets, Lempco Precision Anti-friction..Mar. 195
Die, Spring-actuated Receding Guides for Locating Work in Coining. L. Kasper..Dec. 192
Die Steel that Hardens in Heavy Sections, A Non-deforming ..... Apr. 200
Die Stock Used for Drill Jigs, Masonite..Nov. 165
Dies and Stretch Blocks Employed in Bus Building, Kirksite, R. B. Stubs.....Dec. 168
Dies in Hydraulic Presses, Forging with Closed. C. W. Hinman ..... Feb. 176
Dies, Jones & Lamson Automatic Self-opening Die-heads and Ground-thread Flat Rolling June 208
Dies Made from Sintered Carbide, Blanking and Forming ..... Sept. 236
Diecarb Blanking and Forming Dies.....Sept. 236
Dielectric Heater for Plastic Preforms, G-E July 205
Diesel Engine Drive, Lincoln Welder with Feb. 201
Diesel Engines, A New Development in Railroad Locomotive ..... Aug. 197
Dilworth, Donald D., Personal of.....Nov. 233
Dimpling Tool, Sheet-metal ..... Mar. 199
Dipping, Non-hazardous Solutions Developed for Bright ..... Mar. 184
"Dipwrap" Compound Provides Durable Protection for Metal Products.....Jan. 191
Disintegrator for Removing Broken Taps and Drilling Tungsten Carbide ..... Apr. 236
Disintegrators for Removing Broken Taps and Cutting Hardened Steel ..... Sept. 232
Disney, Roland C., Personal of ..... May 240
Dividing Machines, Gaertner Automatic Linear June 210
DoAll Co.:
A Model One-man Machine Shop.....Feb. 156
"Producto-Chek" Gage Kit .....Feb. 204
"Lifetime" Gage-blocks ..... Feb. 222
Surface Plate of Improved Design.....Apr. 220
High-speed Metal Saw ..... May 199
Friction Band-sawing of Hard Materials June 169
Dobbrodt, A. F., Personal of.....Mar. 230
Dolle, William L., Personal of.....June 247
Dorfan, Morton I., Personal of.....Oct. 236
Douglas Aircraft Co., Inc.:
Flaring Tubes with Carbide Lathe-center Tip ..... Jan. 150
Dow Chemical Co.:
Polystyrene Plastic with Greatly Improved Qualities ..... Sept. 206
Spectrometer Analyzes Alloys in Forty Seconds ..... Jan. 180
Magnesium Used as a Substitute for Wood Feb. 187
Recently Developed Plastic that is Flexible at Low Temperatures ..... Feb. 195
Two Saran Coating Materials Provide Moisture-vapor Protection ..... Aug. 200
Dow Corning Corporation:
Silicone Rubber Becomes Commercially Available ..... Sept. 210
Silicone Varnish for Impregnating Electrical Equipment ..... Jan. 190
Silicone Greases for High- and Low-temperature Bearing Lubrication .... Feb. 194
Silicone Mold Release Fluid and Compound Aid Rubber and Plastic Molding.... Mar. 184
Silicone Insulation for High Temperatures June 173
Silicone Compound Prevents Foaming of Aqueous Solutions and Emulsions....July 197
Dowels for Patterns and Core-boxes, Metal July 209
Drafting Machine, Universal "Boardmaster" Aug. 203
Drafting-room Work, "Robot Rembrandt"—A New Device Facilitating ..... Aug. 186
Drafto Corporation:
Disintegrator for Removing Broken Taps and Drilling Tungsten Carbide ..... Apr. 236
Draftsmen at the Glenn Martin Plant, Training ..... July 173
Drastrup, Alfred B., Personal of.....July 246
Drawing Arcs of Large Radii, "Arcmeter" Instrument for ..... Aug. 214
Drawing Compound for Stamping Operations, Improved ..... Jan. 190
Drawing Compounds for Press Work, Selecting. James McElgin ..... Apr. 157
Drawing Lubricants, Some Points to be Considered in Selecting ..... June 176
Drawing Metal from Around Inner Blanked Hole, Die Designed to Save Stock by. Wallace C. Mills.....Sept. 202
Drawing of Magnesium, Deep-. Ralph G. Gillespie ..... Mar. 145
Drawing of Thin Shells, Hydraulic Strippers Facilitate. Henry F. Hild.....Dec. 147
Drawing on a Single-acting Press, Double-acting Attachment Permits Deep. Fred B. Money.....Aug. 195
Drawings, Aids in Making Three-dimensional May 224
Dresser and Lathe Angle-plate, Grinding Wheel ..... Nov. 212
Dresser, Bemisine Dual-purpose Angle.....Oct. 224
Dresser for Grinding Wheels, J & S Radius- and Angle- ..... Nov. 222
Dresser for Grinding Wheels, Radius and Tangent ..... Sept. 232
Dresser, Samson Grinding-wheel ..... May 212
Dressing Device for Multi-ribbed Thread Grinding Wheels, Diamond ..... Oct. 220
Dressing, see also Crush-dressing
Dressing Tool, Sunnen Diamond.....Aug. 218
Drill Chuck, see Chuck
Drill, Dumore Bench ..... May 210
Drill for Cutting Hardest and Softest Metals Aug. 224
Drill for High-speed Production Drilling, "Jet" Mar. 218
Drill Grinding Fixtures, Improved "Ind-L-Way" ..... Feb. 208
Drill Heads, Zagar Gearless ..... May 210
Drill Jig, see Jig
Drill Life by Reducing Breakage, New Lubricant Lengthens ..... Nov. 175
Drill Press Feed, Bellows-Senacon ..... Nov. 212
Drill Press Filing and Slotting Attachment, Brown ..... Aug. 220
Drill Press Tapping Head, Haskins.....July 205
Drill Presses Increases Production, Rearrangement of Four-spindle ..... Oct. 157
Drill Presses, Turret Attachment for.....Dec. 228
Drill Presses, Weaver Variable-speed Unit for Aug. 210
Drills, Carbide-tipped Core- ..... Oct. 209
Drills, Chicago-Latrobe Stub Screw Machine May 196
Drills, Nelco Carboloy-tipped Twist.....Mar. 216
Drills, Threadwell High-speed Twist.....May 212
Drilled in a Lathe, Centering Device Used in Positioning Work ..... June 196
Drillet Box Jigs ..... Mar. 210
Drilling and Boring Machine, Root Hydraulic-feed Multiple ..... Sept. 220
Drilling and Reaming Rocket-shell Plates, Baker Multiple-spindle Machines for....Sept. 211
Drilling and Reaming Unit, Hesco.....Feb. 220
Drilling and Tapping Machine, Cleveland Horizontal ..... Jan. 198
Drilling Attachment, Commander Multi-spindle ..... Oct. 208
Drilling, Etching, and Cleaning Machine, Automatic ..... Mar. 211
Drilling, Knapp "Pre-Selectric" Power Feeder for Deep-hole ..... Oct. 209
Drilling Machine, Chip-breaker Attachment for May 201
Drilling Machine, Cincinnati Bickford "Super Service" Upright ..... Apr. 211
Drilling Machine, Gisholt Combination Balancing Equipment and ..... July 198
Drilling Machine, LeMaire Heavy-duty Vertical Nov. 210
Drilling Machine, Sibley ..... June 228
Drilling Machine, Simplex Special Five-unit Sept. 228
Drilling Machines, Taylor & Fenn Variable-speed ..... Dec. 208
Drilling, Milling, and Boring Machines....Jan. 199
Drilling, Milling, and Tapping Motor Frames, Davis & Thompson Four-station Indexing Machine for ..... Apr. 205
Drilling, Reaming, Boring, and Tapping Machine, LeMaire Special Wheel-cylinder..Mar. 204
Drilling Seven Holes in Five Different Directions ..... Apr. 159
Drilling, Spot-facing, Counterboring, and Tapping, "Hy-Mac" Special Machine for....July 204
Drilling, Tapping, Boring, and Milling Machine, Giddings & Lewis Multi-purpose..Apr. 210
Drilling to Lay-outs, "Opti-Setter" for Accurate ..... July 224
Drilling Tungsten Carbide, Disintegrator for Removing Broken Taps and .....Apr. 236
Drive, "Servotron" Electronically Controlled Variable-speed ..... Dec. 226
Drives and Other Electrical Equipment for Machine Tools, Present-day Motor. G. A. Caldwell ..... June 164

Drives for Automatic Screw Machines, High-speed Chain ..... Aug. 172
Drives, Horsepower Ratings for Silent Chain ..... Mar. 168
Drivers, Titan Stud- ..... Nov. 220
Drop Forging Association:
Research on Closed-impression Die Forgings ..... July 165
New Officers Elected at Annual Meeting ..... Aug. 193
Ducts for Air, Gases, and Powdered Material, Multi-Flex ..... May 172
Dumore Co.:
High-speed Precision Bench Drill.....May 210
Flexible-shaft Utility Tool ..... June 222
"Dunamatic" Lathe Attachment ..... May 206
"Dunkirk EZ" Steel with Greatly Improved Machinability ..... Nov. 174
Dunn Engineering Co.:
"Dunamatic" Lathe Attachment ..... May 206
Duomatic Lathe for Small Work, Lodge & Shipley ..... Oct. 199
du Pont de Nemours & Co., E. I.:
Improved Explosive Rivet for Peacetime Mass Production ..... Dec. 186
Sodium-hydride Process for Descaling Metals ..... Feb. 187
Nylon Valve Seats Substituted for Those of Metal ..... Mar. 185
Results of Ten-year Aging Test of Neoprene ..... June 176
Reinforced Plastic Resin Tested for Tooling Jigs ..... July 196
Plastic with Unusual Resistance to Acids and High Temperatures ..... Aug. 199
Duplicating Attachment, Bailey ..... May 208
Durand, Dr. William Frederick, Personal of ..... Jan. 211-C
Durez Plastics & Chemicals, Inc.:
Die Set Made of Durez Casting Resin..July 197
"Durok" Electrical Insulating Board Made of Non-cotton Cellulose ..... Nov. 175
Duston, E. W.:
Automatic Hopper Feeds for Small Cylindrical Parts ..... June 193
Dustproofing Concrete Floors, "Synkrete"—A Liquid Developed for ..... Oct. 170
Dye Sets to Permanent Ebony Shade, Black Plastic ..... Mar. 185

E

Eastern Machine Screw Corporation:
Three New Insert-chaser Die-heads.....Jan. 208
Eastman Kodak Co.:
New Scribing Plate for Optical Comparators ..... Aug. 226
Eaton, Dr. James T., Personal of.....Aug. 247
Eatonite Makes Possible Better Valves for Post-war Engines ..... Sept. 206
Eberhardt, Frederick L., Obituary of.....Aug. 248
Eby, J. D., Personal of ..... Dec. 242
Economic System—Dictatorship versus Free Enterprise ..... July 188
Edging Machine Designed to Prepare Plates for Automatic Welding, Thomas.....Dec. 216
Edie, Joseph, Personal of ..... Dec. 239
Edmonds, J. H., Personal of ..... Nov. 230
Education by Means of Drawings, Exploded Views and Transvision, Visual ..... Mar. 180
Education, see also Apprentices, School, Training, Vocation
Educational Films, United States Government ..... May 224
Educational Institutions at Reasonable Prices, Surplus Equipment Should be Available to ..... Aug. 174
Efficiency is a Dangerous Combination, Higher Wages and Less ..... Apr. 194
Eicher, Harold R., Personal of ..... Mar. 236
Ekholm, Lars E., Personal of ..... Apr. 251
Ekholm, Norman R., Personal of.....June 240
"Elastuf" Chrome-vanadium Steel with High Strength and Toughness ..... Jan. 190
Elder, W. F., Personal of ..... Sept. 242
"Elec-draulic" Press, Dake ..... July 220
"Electric-air" Controlled Tapping Machine, Haskins ..... Apr. 208
Electric and Gas-Air Methods of Silver Brazing, Comparative Study of. Paul F. Berg ..... Jan. 151
Electric Eye, see also Photo Electric Tube
Electric Furnace, see Furnace
Electric Starter Developed for Aviation Gas Turbines .....Apr. 191
Electric Welding, see Welding
Electrical Contacts, "Gibsiloy".....Feb. 197
Electrical Equipment for Machine Tools, Standardization of. R. H. Clark.....Jan. 176
Electrical Equipment, Silicone Varnish for Impregnating.....Jan. 190
Electrical Tools, Bradford "Metal Master"..Apr. 213
Electrification Forum, Westinghouse Stages Its Tenth Annual Machine Tool.....May 179
Electro Metallurgical Sales Corporation:
Special Low-carbon Ferro-manganese.....Dec. 197
Electrode, Airco All-position Mild-steel.....Apr. 209
Electrode, Airco Extrusion-coated Self-hardening.....Aug. 203
Electrode Coating Equipment with Improved Features, New.....Sept. 189
Electrode, Cupro-Arc .....Jan. 200
Electrode, Ellwood Improved Cutting.....Sept. 222
Electrode, Ellwood Improved Cutting—Correction .....Oct. 228
Electrode for High-tensile Steels, Improved ..... Oct. 206
Electrodes, All-position High-tensile.....May 195
Electrodes for Hard Facing, Lincoln Improved ..... Mar. 199
Electrodes, Lincoln Improved Stainless-steel ..... Apr. 205
Electrodes, Manufacture of Welding.....Apr. 152
Electrodes, New Murex Welding.....Nov. 178
Electrolimit Ball Gaging Comparator, P & W ..... Mar. 207
Electrolimit Comparator with Ball-sorting Attachment, Pratt & Whitney.....Feb. 218
Electrolimit Continuous Gaging Equipment..Apr. 225
Electrolimit External Comparator, Pratt & Whitney.....Dec. 224
Electrolized Tap Corporation:
"Electrolized" Taps .....May 222
Electrolytically, Process for Polishing Stainless Steels .....Apr. 201
"Electronic Bloodhound" Widens Scope of Oxy-acetylene Cutting Machines.....Jan. 189
Electronic Calculating Machine, Revolutionary ..... Apr. 190
Electronic Contactor, ATC.....May 200
Electronic Control for Power Feed, Fray Milling Machine with.....Sept. 234
Electronic Control Makes Bench Welder a Precise Production Tool. L. J. Gottschalk, Jr. .....Sept. 168
Electronic Control, Reproducing from Patterns or Templets by.....Jan. 175
Electronic Control, Sheffield Templet Grinding Machine with .....Mar. 192
Electronic Equipment Facilitates Wire-rope Manufacture. P. Somerville, L. R. Hunt, and J. D. Campbell.....Jan 171
Electronic Gages, Jack & Heintz.....Dec. 206
Electronic Process, Production of Starter Ring Gears Revolutionized by.....Jan. 192
Electronic Sound Gaging Device for Blind Inspectors .....July 174
Electronic Sound Gaging Device for Use by the Blind .....Sept. 189
Electronically Controlled Variable-speed Drive, "Servotron".....Dec. 226
"Elf" Drill Lubricant.....Nov. 175
Elgin Plug Gages with Flexible Handles....May 204
Elgin Sapphire-tipped Micrometer.....July 222
"Ellpro" Improved Cutting Electrode.....Sept. 222
Ellsworth, Harry M., Personal of.....Jan. 212-B
Ellwood Products Corporation:
Improved Cutting Electrode.....Sept. 222
Improved Cutting Electrode—Correction ..... Oct. 228
Elongation Testers, General Electric.....June 208
Elox Corporation:
Disintegrators for Removing Broken Taps and Cutting Hardened Steel.....Sept. 232
Elwell, Richard D., Personal of.....Nov. 228
Elya, F. W., Personal of.....Oct. 236
Emery, Alfred H., Personal of.....Nov. 228
Empire Live Centers with Interchangeable Points .....Apr. 224
Employer is Purchaser of Product, Real....Oct. 184
Employment by Present Policies, Government and Labor Leaders Prevent Full.....May 187
Employment, How to Best Insure Full.....Mar. 155
Employment of Discharged Veterans, Clearing up a Misconception in the. C. Charles Burlingame .....Nov. 163
Employment, PPA Pricing Policy Does Not Encourage Full .....Mar. 174
Employment Opportunities in Industrial Design, Booklet on .....Oct. 167
Employment, Production is the Main Foundation of Maximum.....Dec. 189
Employment (Re-) of Veterans.....Nov. 159
Employment, Restrictive Union Rules Reduce ..... Mar. 166
Employment, see also Jobs
Enamel Developed to Speed Production, Fast Drying.....Mar. 185
Enamel Stripper Removes Organic Coatings, Enthone.....Apr. 201
Enamels Provide Hard Stainproof Finish, New Synthetic.....Feb. 194
Enco Mfg. Co.:
Lathe Turret with Double Drive.....Mar. 194
End-mill, Nelco Carbide-tipped.....July 214
End-mill Type, Tapered Cutting Tool of....May 220
End-mills and Holders, "Selch".....Aug. 216
Enesay Tool Co.:
Drill for Cutting Hardest and Softest Metals ..... Aug. 224
Engine Developed to Drive Planes on Long Flights, Torpedo-shaped Jet.....May 178
Engine for Small Cars Characterized by Light Weight, Automobile .....Mar. 173
Engine, see Gas, Steam, Oil, Diesel, Airplane
Engine with Horizontal Cylinders, Cast-aluminum Automobile .....Apr. 191
Engineering Products Co.:
Standardized Cylinders .....May 224
Engineers Specialties Division, Universal Engraving & Colorplate Co.:
Universal Lay-out Protractor ..... Mar. 220
"Eniac" Calculating Machine ..... Apr. 190
Enterprise are the Cornerstones of Industry, Initiative and ..... Dec. 188
Enthone Co.:
New Corrosion-resisting Coating for Aluminum and Aluminum Alloys.....Dec. 187
Enamel Stripper Removes Organic Coatings ..... Apr. 201
Eppelsheimer, Dr. D. S., Personal of.....Mar. 230
"Eronel Thermodip" Protects Repair Parts with Plastic Skin ..... Nov. 174
Erickson Tools, Division of Erickson Steel Co.:
Expanding Mandrel with Eccentric Sleeve ..... Jan. 208-B
Collet Type Speed Chuck ..... Jan. 209-C
Erie Foundry Co.:
Fiftieth Anniversary Celebrated ..... Apr. 172
Eriez Mfg. Co.:
Permanent Magnet for Removing Iron Particles from Plastics ..... May 208
Espen-Lucas Machine Works:
Circular Saw Blade Grinder ..... Nov. 218
Etching and Cleaning Machine, Automatic Drilling, ... Mar. 211
Evans, George B., Obituary of ..... July 250
Excel Universal Cutter and Tool Grinding Machine .....Aug. 205
Ex-Cell-O Corporation:
Chip-breaker Attachment for Drilling Machine .....May 201
High-cycle Grinding Spindle and Frequency Generator .....June 228
Taper Inspection Plate .....July 206
High-speed Grinding Spindle .....July 212
Exhibit, Westinghouse Productive Power..July 182
Explosive Rivet for Peacetime Mass Production, Improved .....Dec. 186
Export Trade Requires Imports .....Oct. 228
Exposition, National Metal Congress and..Jan. 183
Exposition to be Staged by Tool Engineers Society, New Era ..... Mar. 175
Extractors, Walton Pipe Tap ..... May 198

F

Facing and Centering Machine, Shaft.....Apr. 204
Facing Attachment, Gidding & Lewis Boring and .....Aug. 209
Facing, Boring, and Thread Milling Machine, Cross Special .....Nov. 200
Facing Ends of Lever Hubs, Fixture for Spot- ..... Mar. 182
Facing, Hard-, see Hard
Facing Large Aluminum Castings on a Milling Machine with a Lathe Tool. H. A. Schreiber ..... Apr. 198
Facing Machine, Gemco Boring and ..... Apr. 210
Facing the Shank End of a Small Forging, Jig for Drilling, Tapping and Spot-....Mar. 182
Farrel-Birmingham Co.:
Backing-up Roll of Roll Grinder Floats on Oil Film ..... Feb. 187
Fastener, Shakeproof Quick-operating.....June 202
Fearless Tool Co.:
"Shearcutter" Tool Bit ..... June 224
"Featherweight" Series of Portable Air Grinders, Kipp ..... Feb. 199
Federal Products Corporation:
Indicator Snap Gage .....Oct. 224
Micrometer with Dial Indicator .....Jan. 208
Gaging Heads for Use with High-precision Air Gage ..... Feb. 218
Dial Gage for Small-size Holes ..... May 204
Small-size Dial Indicators ..... Aug. 224
Fee, Clarence A., Personal of ..... Jan. 212-B
Feed, Bellows-Schacon Drill Press ..... Nov. 212
Feed for "Multipress," Denison Shuttle..May 200
Feed for Nichols Milling Machine, Power Table ..... Feb. 208
Feed, Lipe Pneumatic Bar Stock ..... Mar. 214
Feeds for Small Cylindrical Parts, Automatic Hopper. E. W. Duston ..... June 193
Feeds, Speeds, and Lubricants for Reaming ..... Aug. 157
Feeder for Deep-hole Drilling, Knapp "Pre-Selectric" Power ..... Oct. 209
Feeding Mechanism Designed to Operate Two Slides from One Cam, Intermittent. L. Kasper ..... Sept. 193
Feeding Parts from a Stack, Reciprocating Slide Mechanism for ..... Feb. 190
Feldbush, Harry A., Personal of ..... Sept. 244
Fellows II, Edwin R., Personal of.....Mar. 230
Fellows Gear Shaper Co.:
Theory and Practice of Gear Cutting Shown in Motion-picture Film .....Apr. 188
Ferguson, Malcolm P., Personal of.....July 240
Ferro-manganese Announced by Electromet, Special Low-carbon ..... Dec. 197
Ferry Machine Co.:
Slotting Marine Bearings on Special Planer Type Milling Machine ..... Apr. 151
Fiberglas "Milled" Fibers—A New Reinforcing Agent ..... Dec. 186
"Fibron" Heat-resisting Plastic Tubing....Mar. 185
Fidelius, Walter R., Personal of ..... June 242
Field, Michael:
Milling Cast Iron with Carbide Cutters..Sept. 153
Fifty Plus Machine Shop:
Jig for Drilling Cross-pin Holes in Shafts and Studs ..... Feb. 212
File and Die Grinder, "Air-Horse" Rotary..July 208
File, Kennametal Disk Type ..... Aug. 218
File, Kennametal Lathe ..... Sept. 236
Files and Burrs, Nicholson Rotary.....Dec. 222
Files and Hones, Diamond "R" ..... Feb. 224
Files, Tungsten-carbide Rotary ..... Dec. 230
Filing and Slotting Attachment, Brown Drill Press ..... Aug. 220
Filing Machine, Precision Die- ..... Feb. 204
Films, see Motion Pictures
Filter for Grinder Coolant, Cuno.....Dec. 216
Filters, Honan-Crane Sump Cleaners and Coolant ..... Feb. 216
Filtering and Lubricating Unit, Logan Air Regulating, ... Jan. 204
Finish-sharpening of Carbide Tools, Honing Wheel Facilitates ..... June 176
Finish Standards, Pocket-size Set of Surface ..... Dec. 218
Finishes, The Comparoscope—An Optical Instrument for Evaluating Surface.....Sept. 191
Finishing of Small Parts, Roto-Finish Machine for Mechanical ..... Mar. 202
Finishing Problems, Coated Abrasives Solve Many Reconversion Metal- ..... June 174
Finishing Process, New Mechanical.....Aug. 194
Fink, Harry W., Personal of ..... May 239
Finn, W. A., Personal of ..... Mar. 235
"Fi-Retard Liquid" Makes Foundry Molds Fire-resistant ..... Sept. 207
First-aid Use, Portable Source of Heat for ..... July 175
Firth-Sterling Steel Co.:
Blanking and Forming Dies Made from Sintered Carbide ..... Sept. 236
High Production with Carbide Nib Molds ..... Oct. 230
Fish-Schurman Optical Contour Comparator ..... Apr. 217
Fisher, A. F., Personal of ..... Dec. 244
Fitzpatrick, H. J., Personal of..... Nov. 228
Fixture, see Milling, Bending, Drilling, Indexing, etc.
Fixtures for Use with Precisionaire Instruments, "Airsnap" ..... May 204
Flame-cut to Shape, Teeth of Rack.....Oct. 230
Flame-cutting of Stainless Steel Made Possible by New Equipment ..... Sept. 190
Flame-cutting Stack of Sheets Provides Fabricating Short-cuts ..... Nov. 160
Flame-hardening Set-up for Small Machined Parts ..... Feb. 172
Flaring Tubes with Carbide Lathe-center Tip ..... Jan. 150
"Flash Freeze" Unit for Industrial Cold-treatment ..... Apr. 217
Flat Steel Springs, Utilizing Residual Forming Stresses in. W. C. Troy.....June 152
Flat-top Broaching Machines, Colonial....Feb. 203
"Fleet Arc Jr." Welder, Lincoln ..... Dec. 208
Fletcher, Dr. Stewart G., Personal of....Feb. 240
Flexible-shaft Grinder, Leigh High-speed..June 230
Flexible-shaft Utility Tool, Dumore.....June 222
Flex-Tube Non-metallic Three-way Valve..July 209
Floor Cleaner Developed for Cement and Tile Floors, Heavy-duty ..... June 198
Floors Smooth, Unusual Application of Carbide Tools Keeps Shop ..... Feb. 186
Floors, "Synkrete"—A Liquid Developed for Dustproofing Concrete ..... Oct. 170
Florence, Herbert T., Personal of.....July 245
"Flo-Well No. 1" Flux for Gas-welding Aluminum ..... Jan. 191
Flowers, Alan Estes, Obituary of.....Jan. 212-B
Flux and Welding Scale from Metal, Compound for Removing ..... Nov. 175
Flux for Aluminum Soldering, Brazing, or Gas Welding ..... Dec. 196

Flux for Gas-welding Aluminum, Improved ..... Jan. 191
Flux-Injection Cutting Equipment ..... Sept. 190
Flux Reaches Maximum Fluidity at Low Temperature, Silver Brazing ..... Apr. 200
Flux that Leaves No Harmful Residues, A Soft ..... Feb. 195
Foaming of Aqueous Solutions and Emulsions, Silicone Compound Prevents ..... July 197
Fobian, George H., Personal of ..... Nov. 233
Fog or Steam on Glass or Plastic Surfaces, Liquid Prevents ..... Jan. 191
Fonda Gage Co.:
Carbide Gage-blocks ..... Nov. 204
No. 82-C Tungsten-carbide Gage-block Set ..... Jan. 199
Carbide Gage-blocks—Correction .... Jan. 209-C
Foot Control and Valve for Air-operated Equipment, Redmer ..... Dec. 226
Foote, Walter C., Personal of ..... Aug. 238
Ford Motor Co.:
Magnetic Inspection of Bar Stock.....Sept. 171
Machine Grouping Eliminated Center-wing Bottlenecks ..... Oct. 162
Dealers Offer Veterans an "Earn While You Learn" Training Program ..... Feb. 248
New Method of Balancing Crankshafts..Mar. 156
Plastic Glazings Tested for Automobile Windows ..... Apr. 201
Automobile Body Parts Coated with Phosphate for Long Life ..... June 185
Cylinder Sleeve Production Embodies Unique Engineering Ideas .....July 139
Research and Engineering Center Planned ..... July 168
Ford II, Henry:
The Human Factor in Mass Production..Feb 182
Ford, Thomas C., Personal of ..... Feb. 245
Forging Aluminum Aircraft Pistons on Mechanical Presses. Charles O. Herb.....Nov. 149
Forging of Magnesium, The. Arnold L. Rustay and Franklin B. Rote .....June 141
Forging Operations, Automatic Induction Heating Equipment for ..... Sept. 226
Forging with Closed Dies in Hydraulic Presses, C. W. Hinman ..... Feb. 176
Forgings, Research on Closed-impression Die ..... July 165
Forming, Typical Examples of Contour. Cyril J. Bath ..... Apr. 181
"Formsprag" Over-running Clutch ..... Sept. 238
Formula? Just What is the Clayton.....Feb. 174
Forstrom, E. E.:
Counterboring Obstructed Holes ..... Nov. 182
Forum, Westinghouse Stages Its Tenth Annual Machine Tool Electrification ..... May 179
Foulk Engineering Co.:
Retract-A-Tool for Thread Cutting.....May 222
Foundry Molds Fire-resistant, Compound Makes ..... Sept. 207
Foy, Byron C., Personal of .....July 245
Foy, Mable:
Use of Solvents in Cleaning Machinery for Reconversion ..... Dec. 165
Franklin, Harry D., Personal of ..... Mar. 236
Franzreb, Thomas G., Personal of ..... Aug. 236
Frary, Dr. Francis C., Personal of ..... Nov. 233
Fraser, George T., Personal of ..... Dec. 244
Frauenthal, A. Harold, Personal of.....Nov. 224
Fray Machine Tool Co.:
Milling Machine with Electronic Control for Power Feed ..... Sept. 234
French, H. J., Personal of ..... Oct. 238
Frick, George W., Personal of ..... May 240
Friction Band-sawing of Hard Materials. Charles H. Wick ..... June 169
Friction Cutting of Metals by Band Saws. H. J. Chamberland ..... Oct. 188
Frontier Bronze Corporation:
Motion Picture on New Aluminum Alloy ..... May 173
Furnace, Dual-purpose ..... Dec. 210
Furnace Equipment for Bright-hardening. C. E. Peck ..... Mar. 178
Furnace for Preheating Magnesium Sheets ..... Jan. 208-B
Furnace, Rockwell Automatic Pusher Type Normalizing ..... Mar. 197
Furnace, Sentry Electric Heat-treating....Feb. 226
Furnaces, Cooley Small-size Heat-treating..May 206
Fuse Adapters on Landmaco Machine, Special Fixture for Threading ..... Oct. 212

G

Gaertner Scientific Corporation:
Automatic Linear Dividing Machines..June 210
Gaffney, F. J., Personal of ..... May 239
Gage, Adjustable Flush-pin ..... Dec. 216
Gage-blocks, DoAll "Lifetime" ..... Feb. 222
Gage-blocks, Fonda Carbide ..... Nov. 204
Gage-blocks, Fonda Carbide ..... Jan. 199
Gage-blocks, Fonda—Correction ..... Jan. 209-C
Gage Bushings. Carboloy ..... Feb. 220
Gage, Chesterman Large-sized Height.....Apr. 217
Gage, Federal Indicator Snap ..... Oct. 224
Gage for Checking Pump Gears, Simple. G. A. Almorth ..... Dec. 193
Gage for Checking Special Screw Threads by Single-wire Method. Daniel E. McDonald ..... Oct. 190
Gage for Checking the Height of Burrs. Peter L. Budwitz ....Apr. 196
Gage for Inspecting Bonds of Laminated Materials or Measuring Sheet Thickness....May 224
Gage for Magnetic-particle Testing, G-E Magnetic-field ..... Aug. 208
Gage for Small-size Holes, Federal Dial....May 204
Gage-head, Lightronic ..... July 207
Gage Kit, DoAll "Producto-Chek" .....Feb. 204
Gage, "Micro-Planer" ..... Aug. 216
Gage, Moore Pneumatic Comparator ..... Oct. 220
Gage Simplifies Lay-out and Inspection Operations, Multiple Height ..... Sept. 187
Gage, Small Dial Type ..... May 218
Gage, Thread, see Thread
Gage, Yankee Precision Electric Surface..Jan. 200
Gages and Precision Instruments for the Smithsonian Institution ..... Sept. 161
Gages and Thread-measuring Wires, Cemented-carbide Reversible-wire Plug ..... Apr. 224
Gages and Thread-measuring Wires, Van Keuren Carboloy Plug ..... Mar. 216
Gages, Extra Clearance Provided at the Roots of Thread Ring ..... Jan. 192
Gages for Measuring Hole Diameters, Moore Leaf Taper ..... July 222
Gages for Setting Form Tools and Gaging Lengths, Smith ..... Apr. 230
Gages, Jack & Heintz Electronic ..... Dec. 206
Gages, Webster Hardness ..... Aug. 216
Gages with Flexible Handles, Elgin Plug..May 204
Gaging Device for Blind Inspectors, Electronic Sound ..... July 174
Gaging Device for Use by the Blind, Electronic Sound ....Sept. 189
Gaging Equipment, Electrolimit Continuous ..... Apr. 225
Gaging Heads for Use with High-precision Air Gage, Federal ..... Feb. 218
Gaging, see also Inspection, Testing
Gairing Tool Co.:
Milling Cutter Saves Ten Thousand Man-hours a Year ..... Oct. 166
Gaites, G. H., Personal of ..... Apr. 246
Galanot Products Co.:
"Selch" End-mills and Holders ..... Aug. 216
Gallmeyer & Livingston Co.:
Grand Rapids Hydraulic-feed Universal and Tool Grinding Machines ..... Nov. 204
Grand Rapids Universal Cutter and Tool Grinding Machine ..... Jan. 200
Galloway, Dr. D. F.:
Equipment Designed to Facilitate the Use of Diamond Tools ..... June 179
Gardner, Robert H., Personal of ..... Sept. 249
Garinger, J. D., Personal of ..... Mar. 228
Garlick, R. C., Personal of ..... Aug. 247
Garnett, A. C., Personal of ..... July 245
Garretson, Richard F., Personal of ..... June 247
Garrison, J. Russell, Obituary of ..... Sept. 252
Garst, Stephan D., Personal of .....Mar. 228
Gas-Air Methods of Silver Brazing, Comparative Study of Electric and. Paul F. Berg ..... Jan. 151
Gas or Liquid Pressure, Instrument for Accurately Measuring ..... Oct. 187
Gas Turbines to Furnish Power for Airplanes ..... Mar. 173
Gaybex Corporation:
Safety Solvents for Cleaning Precision Bearings and Instrument Parts .....Mar. 185
Gear-boxes, Methods of Locating and Boring Shaft Holes in ..... June 195
Gear Cutting Illustrated in Motion-picture Film, Theory and Practice of ..... Apr. 188
Gear Grinding Machine Co.:
"Formsprag" Over-running Clutch .... Sept. 238
Ballflex Flexible Couplings ..... Apr. 224
Gear Grinding Machine for Spur or Helical Gears, Pratt & Whitney Universal.....Oct. 204
Gear-measuring Wires, Van Keuren Carboloy ..... June 226
Gear Production, Industrial:
Dec. 146, Jan. 160, Feb. 171, Apr. 172, June 171, July 187, Aug. 166
Gear Production Problems Solved by Automatic Welding. R. P. Sharer ..... Nov. 153
Gear-shaving Machine, Red Ring Internal..Oct. 214
Gear-tooth Strength Calculator ..... May 242
Gear Tooth Wear and Failure ..... Apr. 166
Gears and Gearing, see also Bevel, Helical, Spiral, Spur, Worm
Gears for Pumps, Tool-room Precision on a Mass Production Basis in Making. Charles O. Herb ..... Oct. 139
Gears, Michigan Sine-line Lead Comparator for Helical ..... July 202
Gears on Landmaco Machine, Special Chuck for Threading Hypoid ..... Nov. 215
Gears Revolutionized by Electronic Process, Production of Starter Ring ..... Jan. 192
Gears, Simple Gage for Checking Pump. G. A. Almorth ..... Dec. 193
Gegenheimer, L. H., Personal of ..... Oct. 240
Geier, Frederick V., Personal of ..... July 245
Geiger, Harold L., Personal of ..... July 238
Gelbar, Samuel S.:
Friction-drive Tapping Machine ..... Jan. 204-B
"Star" Live Centers ..... Feb. 220
Gellhorn, Commander George, Personal of..Jan. 212
Gemco Boring and Facing Machine ..... Apr. 210
Gemco Shaper with "Lubrigard" Safety Device ..... Feb. 202
Gemmell, R. W., Personal of ..... Apr. 251
General Ceramics & Steatite Corporation:
New Ceramic Material Has Unusual Dimensional Stability ..... Dec. 197
General Detroit Corporation:
Compound Makes Foundry Molds Fire-resistant ..... Sept. 207
General Electric Co.:
Molding Presses for the Plastics Industries ..... Sept. 172
Multiple Height Gage Simplifies Lay-out and Inspection Operations ..... Sept. 187
Rearrangement of Four-spindle Drill Presses Increases Production ..... Oct. 157
Reproducing from Patterns or Templets by Electronic Control ..... Jan. 175
Electronic Control Widens Scope of Oxy-acetylene Cutting Machines ..... Jan. 189
Weld-spatter-resistant Compounds .... Jan. 204-B
"Strike-easy" Arc-welding Compound ..... Jan. 208-B
Plastic Compound Used for Sealing Caps and Sleeves ..... Feb. 194
Magnetic Hardness Tester for Small Ferrous Metal Parts ..... Feb. 198
Torpedo-shaped Jet Engine Developed to Drive Planes on Long Flights.....May 178
Enclosed Fan-cooled Motor ..... May 218
"This is Resistance Welding"—Motion Picture ..... June 182
Standard Grays for Engineering Equipment ..... June 192
New Plastic Shows Improved Qualities in Heat Test ..... June 198
Elongation Testers for Copper Wire .... June 208
Strain-gage Amplifier ..... June 230
Five New Permanent-magnet Materials..July 236
Instrument that Records Presence of Chemical Elements in Materials ..... Aug. 187
Improvements in Molding Technique Widen Mycalex Applications ..... Aug. 199
Magnetic-field Gage for Magnetic-particle Testing ..... Aug. 208
Automatic Humidity Recorder ..... Aug. 220
General Engineering & Mfg. Co.:
Gemco Shaper with "Lubrigard" Safety Device ..... Feb. 202
Gemco Boring and Facing Machine....Apr. 210
General Machinery Corporation:
Hundredth Anniversary Celebrated .... Nov. 233
General Mfg. Co.:
Flexible-power Mechanical Press ..... Feb. 201
General Motors Corporation:
Cleaner Products Obtained by Exhausting Fine Chips from Milling Machines....Aug. 172
General Tool & Die Co.:
Copper "Cushioned" Tool Bits ..... Dec. 200
Milling Cutter with "Cushioned" Blades ..... Feb. 213
Performance of Milling Cutters with Cushioned Blades ..... Mar. 186
Generator, High-cycle Grinding Spindle and Frequency ..... June 228
Geometric Tool Company, The:
Die-head of Improved Design ..... July 216
Germany Built Up Its Manufacturing Industries, How ..... Dec. 180
Gerotor May Corporation:
Floating Piston Type Hydraulic Valve..Feb. 224
"Gibsiloy" Electrical Contacts ..... Feb. 197
Gibson Electric Co.:
"Gibsiloy" Electrical Contacts ..... Feb. 197
Giddings & Lewis Machine Tool Co.:
Multiple-purpose Machine Tool ..... Apr. 210
Boring and Facing Attachment ..... Aug. 209
Giern & Anholtt Tool Co.:
Vertical Machine for Boring Large Cylinders ..... Aug. 208
Gilchrist, Fred W., Personal of ..... Sept. 242
Gillespie, Ralph G.:
Deep-drawing of Magnesium ..... Mar. 145
Gillies, Fred M., Personal of ..... Feb. 234
Gilmore, Donald H., Personal of ..... Mar. 236
Ginter, C. W., Personal of ..... Mar. 236
Girardin, Howard N., Personal of ..... Mar. 228
Gisholt Machine Co.:
The Microbalancer—A Supersensitive Balancing Machine ..... Jan. 181
Two-element Unbalance Measuring and Correcting Equipment ..... July 198
Givens, W. A., Obituary of ..... July 250
Glass or Plastic Surfaces, Liquid Prevents Fog or Steam on ..... Jan. 191
"Glass" Panels for Control Boards, Plastic ..... Oct. 232
Glazings Tested for Automobile Windows, Plastic ..... Apr. 201
Gleason Works:
Quenching Press ..... Mar. 198
Gleeson, W. W., Personal of ..... Sept. 242
Gloetzner, Alvin A., Personal of ..... June 238
Goddard, C. S., Personal of ..... Sept. 242
Godfrey, Captain Vincent H., Personal of ..... Jan. 212-B
Goggle Designed to Provide Greater Safety and Comfort, Dust ..... Jan. 209-C
Goggle Lenses, Anti-fog Preparation for Industrial ..... Sept. 171
Golosman, Charles:
Rotating Disk-and-pin Mechanism for Controlling Cutter-head Slide of Automatic Cam-generating Device ..... Aug. 189
Goodier, Professor J. N., Personal of.....July 245
Goodrich Chemical Co., B. F.:
Kriston—A Non-flammable Thermosetting Plastic ..... Dec. 196
Gordon, Frank H., Personal of ..... Sept. 249
Gordon, John D.:
Resistance Welding with Storage-battery Power ..... Aug. 167
Gordon, John D., Personal of ..... Dec. 242
Gotberg, Harry H.:
Surface Broaching Simplifies Machining of Valve Rocker Arms ..... Sept. 176
Gottschalk, Jr., L. J.:
Electronic Control Makes Bench Welder a Precise Production Tool ..... Sept. 168
Government and Labor Leaders Prevent Full Employment by Present Policies ..... May 187
Government by Emergency ..... May 158
Government Controls Lead to Bureaucratic Dictatorship ..... Apr. 178
Government Controls Once Adopted Seem Hard to Get Rid of ..... Apr. 192
Government Hamper an Industry Vital to Prosperity? Why Does ..... June 186
Government Policy Discourages New Enterprises ..... May 177
Government Surplus Should be Placed on the Market Quickly ..... Oct. 228
Govro-Nelson Co.:
Axial Relief Grinding Fixture ..... July 224
Graf, E. H. H., Personal of ..... May 232
Graham, W. R.:
Unusual Results with Automatic Soldering ..... Oct. 158
Grand Rapids Hydraulic-feed Universal and Tool Grinding Machines ..... Nov. 204
Grand Rapids Universal Cutter and Tool Grinding Machine ..... Jan. 200
Granquist, Milton, Personal of ..... Dec. 248
Grant, Charles U. S., Personal of.....May 240
Grant, David, B., Personal of ..... June 240
Gray Co., G. A.:
Traveling-head Milling Machine ..... Apr. 214
Non-metallic Ways for Machine Tables..May 208
Gravhill:
Demagnetizer for Small-diameter Tools..Jan. 195
Gray-Mills Corporation:
Three New Cleaning Systems ..... Jan. 205-A
Bronze Gear Pump ..... June 212
Grays for Engineering Equipment, Standard ..... June 192
Grease for Ball and Roller Bearing Motors, Improved ..... Dec. 196
Greases for High- and Low-temperature Bearing Lubrication, Silicone ..... Feb. 194
Greenall, Lieutenant Colonel Charles H., Personal of ..... Mar. 236
Gregory, C. V., Personal of ..... July 246
Griffin Co., George O.:
"Reverso" Thread Plug Gage ..... May 220
Grinder, "Air-Horse" Rotary File and Die ..... July 208
Grinder Attachment, High-speed Surface..July 208
Grinder, Baldor ..... Apr. 230
Grinder, Bradford "Metal Master" ..... Apr. 213
Grinder, Espen-Lucas Circular Saw Blade ..... Nov. 218
Grinder Floats on Oil Film, Backing-up Roll of Roll ..... Feb. 187
Grinder for Sharpening Staybolt Taps .... Dec. 210
Grinder, Hager Carbide-tool ..... Feb. 200
Grinder, Leigh High-speed Flexible-shaft..June 230
Grinder, New Line of Attachments for Hager Carbide-tool ..... June 216
Grinder, Sander, and Circular Saw, Parlec Combination ..... Apr. 214
Grinder, Thin-body Chuck for Blake Tap..Apr. 207
Grinder Ways, Carbide Used for Tool.....Dec. 160

Grinders & Fixtures, Inc.:
Cleveland Indexing Head ..... July 218
Grinders, Kipp "Featherweight" Series of Portable Air ..... Feb. 199
Grinding and Lapping Machine, Wickman-Neven Bench ..... Aug. 211
Grinding and Polishing, Demonstration Rooms for ..... Mar. 240
Grinding and Tool Sharpening Machine, Landis Universal ..... Sept. 224
Grinding Attachment, Cincinnati Radius..Apr. 207
Grinding, Belt—One of the Later Developments in the Grinding Field. W. A. Papworth.....Dec. 155
Grinding, Centerless, see Centerless
Grinding Conical Surfaces on Small Pivot Screws, Equipment for ..... Sept. 185
Grinding Fixture, Govro-Nelson Axial Relief ..... July 224
Grinding Fixture, Scherr All-purpose Tool- ..... May 216
Grinding Fixtures, Improved "Ind-L-Way" Drill ..... Feb. 208
Grinding Fluid, Water-soluble "Microgrind" ..... May 218
Grinding Lathe Tools to Eliminate Chatter. C. W. Christiansen ..... May 174
Grinding Machine, Bryant Internal ..... Mar. 191
Grinding Machine, Carbide-tool ..... May 208
Grinding Machine, Cincinnati Monoset Cutter and Tool ..... May 194
Grinding Machine, "Curved Clearance" Reamer and Cutter ..... Dec. 201
Grinding Machine, Excel Universal Cutter and Tool ..... Aug. 205
Grinding Machine for Heavy Diesel-engine Crankshaft, Landis Hydraulic Crankpin..Jan. 197
Grinding Machine for Spur or Helical Gears, Pratt & Whitney Universal Gear ..... Oct. 204
Grinding Machine, Grand Rapids Universal Cutter and Tool ..... Jan. 200
Grinding Machine, Hanchett Duplex Rotary Surface ..... Oct. 206
Grinding Machine, Hobart Buffing and....Mar. 206
Grinding Machine, Lidkoping Centerless..Feb. 203
Grinding Machine, Milled Parallels for Holding Work on Magnetic Table of. Frank Horack ..... June 197
Grinding Machine, Newton Radius-link....Jan. 194
Grinding Machine, Precision Internal.....May 198
Grinding Machine, Profile .....Aug. 204
Grinding Machine, Royal Oak Tool.....Aug. 208
Grinding Machine, Simple Method of Duplicating Cam Surfaces on a Surface. Fritz L. Keller .....July 194
Grinding Machine, Thompson Cam-a Form Contour.....Sept. 226
Grinding Machine with Electronic Control, Sheffield Templet .....Mar. 192
Grinding Machine with Wheel-forming Crusher Rolls, "Truforming" .....Apr. 203
Grinding Machines, Arter Rotary Surface ..... Jan. 204-B
Grinding Machines, Cincinnati Precision Center-type Plain .....Apr. 212
Grinding Machines Equipped with New Headstock, Cincinnati Hydraulic Universal....Feb. 198
Grinding Machines, Grand Rapids Hydraulic-feed Universal and Tool.....Nov. 204
Grinding Machines, Inspection on Jig-boring and Jig-. J. R. Moore.....Apr. 160
Grinding Machines Promote Interchangeability in Tool-making, Jig-boring and Jig-. J. R. Moore.....Mar. 163
Grinding of Milling Cutters for Continuous Production, Rapid .....Feb. 179
Grinding on a Cylindrical Grinder, Cam. Frank Zagar .....Feb. 180
Grinding Practice, Modern Flat Surface. J. C. Arndt and W. S. Hallowell:
1.....May 168
2.....June 158
3.....July 169
Grinding, Some Considerations in Internal..June 172
Grinding Spindle and Frequency Generator, High-cycle ..... June 228
Grinding Spindle, Ex-Cell-O High-speed....July 212
Grinding Wheel, see Wheel
Grip Designed to Hold Plastic Specimens, Testing-machine .....Oct. 209
"Grip-Master" Vise, Heinrich.....Jan. 209-A
"Grip-Slide" Threading and Tauping Tool..June 220
Gripping Inserts for Holding Devices, Kennametal ..... July 224
Grobe, Dr. Arthur H., Personal of.....Feb. 245
Groove, Drill Jig for Producing Semi-circular ..... May 184
Grooving-tool Blades, Kennametal Solid....Aug. 222
Gross, Charles, Personal of.....May 239
Grouping Eliminated Center-wing Bottlenecks, Machine.....Oct. 162
Grove Regulator Co.:
Non-metallic Three-way Valve ..... July 209
"G-Sol" Safety Solvents for Cleaning Precision Bearings and Instrument Parts.....Mar. 185
Guarantees for Equipment, Service. Leo T. Parker.....Aug. 194
Guard, Dake Punch Press.....May 218
Guard for Power Presses, Searjeant.....Jan. 205-B
Guba, F. A., Personal of.....Dec. 244
Guerin, Henry E., Personal of.....Jan. 211-C
Gulf Oil Corporation:
Oil Exploration from Air Made Possible by "Flying Eye" ..... July 227
Gun, Cherry Rivets and Pneumatic-hydraulic Rivet.....Jan. 209-A
Gustafson, Cleo E., Personal of.....Feb. 234
Gustafson, Floyd C., Personal of.....Oct. 238

H

Haan, E. R., Personal of.....Sept. 242
Hacksaw Blades, Obtaining Full Value from Power. Benjamin Melnitsky.....July 176
Hager & Son, E. F.:
Carbide-tool Grinder .....Feb. 200
New Line of Attachments for Hager Carbide-tool Grinder .....June 216
Halfco Products Co.:
Self-aligning Spherical Bearing.....Dec. 230
Hall, A. P., Personal of.....July 245
Hall, John D., Personal of.....Apr. 252
Hallander Tool Co., Edward:
Notching Press.....Dec. 212
Hallier, David M., Personal of.....July 246
Hallowell, W. S.:
Modern Flat Surface Grinding Practice..May 168
Surface Grinding with Cylinder and Segmental Wheels.....June 158
Surface Grinding with Periphery of Straight Wheels.....July 169
Hamacher, J. D., Personal of.....Aug. 238
Hammer, Small Pneumatic.....Oct. 226
Hanchett Mfg. Co.:
Duplex Rotary Surface Grinding Machine ..... Oct. 206
Magnetic Chuck with All-steel Top Plate ..... Nov. 208
Hancock, William A., Personal of.....Jan. 212
Handschumacher, Captain A. G., Personal of ..... Jan. 212-B
"Handy Hoister," Lewis-Shepard Improved ..... Feb. 213
Hanna Engineering Works:
Air and Hydraulic Control Valves.....Apr. 222
Hanson-Van Winkle-Munning Co.:
Manodyz Process for Manganese.....Jan. 154
Hard-facing Alloys for Electric Arc Application ..... Dec. 197
Hardened Steel Rollers.....Oct. 194
Hardening, Flame, see Flame-hardening
Hardening, Furnace Equipment for Bright-. C. E. Peck .....Mar. 178
Hardening, Induction, see Induction
Hardening of Tools and Machine Parts in Controlled Atmospheres, Bright-. C. E. Peck ..... Feb. 158
Hardening, see also Heat-treatment
Hardig, E. G., Personal of .....June 238
Hardinge Brothers, Inc.:
High-speed Precision Lathe.....Nov. 198
Collet-holding Fixture .....Mar. 216
Precision Second-operation Machine Designed for High-speed Production.....July 201
Hardness Gages, Webster.....Aug. 216
Hardness Tester for Small Ferrous Metal Parts, Magnetic .....Feb. 198
Hardness Testing, Application of Cemented Carbides in .....Jan. 168
Hardness Testing Hammer for Portable Use ..... Sept. 188
Hardness Testing Unit, Wilson Universal....July 220
Hardy, C. L., Personal of.....Mar. 236
Harrell, Fred E., Personal of.....Sept. 246
Harrington, Carlos E., Personal of.....Mar. 235
Harris, Irving, Personal of.....Nov. 224
Harris, J. R. G., Personal of.....May 240
Harrison, Charles, Personal of.....July 240
Hartig, Ernest L., Personal of.....Aug. 236
Harvill Mfg. Co., H. L.:
New Line of Die-casting Machines.....Oct. 200
Automatic Hydraulic Die-casting Machine ..... Dec. 199
Heavy-duty Die-casting Machines.....Jan. 205-B
Harwood, Robert N., Personal of.....May 239
Haskins Co., R. G.:
"Electric-air" Controlled Tapping Machine ..... Apr. 208
Drill Press Tapping Head.....July 205
Hawks, F. C., Personal of.....Apr. 244
Hawley, Frank M., Personal of.....Aug. 240
Haynes Stellite Co.:
Precision Casting on a Mass Production Basis .....May 149
Secret Wartime High-temperature Alloys Now Available for Peacetime Use.....July 183
Heald Machine Co.:
Set-ups That Solved Nine Borizing Problems ..... Jan. 162
Heat for First-aid Use, Portable Source of..July 175
Heat-treating Furnace, Sentry Electric.....Feb. 226
Heat-treating Furnaces, Cooley Small-size..May 206
Heat-treating Ring Gears by Electronic Process ..... Jan. 192
Heat-treating, see also Hardening
Heater for Plastic Preforms, G-E Dielectric ..... July 205
Heater for Production Soldering, Marion Induction .....Mar. 204
Heating, Induction, see Induction
Heating Unit, Thermall High-frequency....May 196
Hecht, Irving A., Personal of.....July 238
Hedstrom, Arne, Personal of.....May 232
Heim Co.:
Mono-ball Bearings and Spherical Bearing Rod Ends.....Sept. 214
Heinrich "Grip-Master" Vise.....Jan. 209-A
Heintz, Charles E., Personal of.....May 234
Helical Cutter with Adjustable Blades. Charles F. Smith .....July 193
Heller, Carl M., Personal of.....Feb. 236
Heller, Sr., Alfred L., Personal of.....June 242
Helm, Edward E., Personal of.....Mar. 236
Hendy Iron Works, Joshua:
"Curved Clearance" Reamer and Cutter Grinding Machine .....Dec. 201
Henry, J. P., Personal of.....Apr. 254
Heppenstall Co.:
Prehardened Die Steel for Use in Zinc-alloy Die-casting.....June 198
Herb, Charles O.:
Tool-room Precision on a Mass Production Basis .....Oct. 139
Forging Aluminum Aircraft Pistons on Mechanical Presses.....Nov. 149
Ford's New Method of Balancing Crankshafts .....Mar. 156
Precision Casting on a Mass Production Basis .....May 149
Cylinder Sleeve Production Embodies Unique Engineering Ideas.....July 139
Cold-forming Oldsmobile Three-piece Bumpers.....Aug. 141
Herbert, W. B., Personal of.....July 245
Herman, Fred W., Personal of.....June 238
Hermann, C. C., Personal of.....Sept. 242
Herty, Jr., Dr. Charles H., Personal of....Dec. 246
Hesco Drilling and Reaming Unit.....Feb. 220
Hess, Dr. Wendell F., Personal of.....Nov. 226
"Hi-bake" Enamels Provide Hard Stainproof Finish, New All-synthetic.....Feb. 194
Hickey, F. C., Personal of.....Dec. 244
Higgins, Roland S., Personal of.....Aug. 238
High-speed Steel, Application of Nusite—A Specially Heat-treated. Arthur A. Schwartz ..... Sept. 186
High-speed Steels, Even Distribution of Free Carbides Improves .....Aug. 198
High-temperature Alloys Now Available for Peacetime Use, Secret Wartime.....July 183
Hild, Henry F.:
Hydraulic Strippers Facilitate Drawing of Thin Shells .....Dec. 147
Hill, Lieutenant Colonel Harold N., Personal of .....Mar. 236
Hilton, N. C., Obituary of.....May 242
Hindman, William P.:
High-quality Tank Manufacture.....Jan. 135
Hinman, C. W.:
Forging with Closed Dies in Hydraulic Presses.....Feb. 176
Hoard, William E., Personal of.....Oct. 234
Hobart Brothers Co.:
Pedestal Type Buffing and Grinding Machine ..... Mar. 206
Hobbing Machine for Heavy-duty Work, Barber-Colman Improved.....Apr. 208
Hobbing Machine, see Gear Hobbing Machine
Hochbaum, Adolph G., Personal of.....Oct. 240
Hoddeson, Paula S., Personal of.....Jan. 212
Hodnette, John K., Personal of.....Apr. 252
Hoefer Mfg. Co.:
Drilling Seven Holes in Five Different Directions.....Apr. 159
Hoeflich, Edward C., Personal of.....Nov. 233
Hoenicke, Edward C., Personal of.....Dec. 246
Hoffer, James F., Personal of.....Apr. 244
Hoist, Lewis-Shepard Improved.....Feb. 213
Hoists, Taylor Utility.....July 208
Holding Work on Magnetic Table of Grinding Machine, Milled Parallels for. Frank Horack ..... June 197
Hole and Washer Cutter, Wyco Heavy-duty ..... July 222
Hole Diameters, Moore Leaf Taper Gages for Measuring.....July 222
Hole Engineering Service:
Hesco Drilling and Reaming Unit.....Feb. 220
Hollow-milling Machine, LeMaire Heavy-duty ..... Jan. 204
Homewood, John:
A Mathematical Problem.....Oct. 194
Honan-Crane Corporation:
Oil Clarifier.....Nov. 216
Sump Cleaners and Coolant Filters.....Feb. 216
Hones, Bay State Diamond Hand.....Oct. 224
Hones, Diamond "R" Files and.....Feb. 224
Hones, Half-round Diamond-impregnated Hand ..... Sept. 234
Honing Technique, Progress in.....Feb. 185
Honing Wheel, Diamond Cup-shaped.....Jan. 208
Honing Wheel Facilitates Finish-sharpening of Carbide Tools .....June 176
Hopkins, Nelson M., Personal of.....May 239
Hopper Feeds for Small Cylindrical Parts, Automatic. E. W. Duston.....June 193
Horack, Frank:
Milled Parallels for Holding Work on Magnetic Table of Grinding Machine.....June 197
Horsepower Ratings for Silent Chain Drives ..... Mar. 168
Horton, Holbrook L., Personal of.....Mar. 235
Hose, Flexible Stainless-steel .....Oct. 170
Hosford, William F., Personal of.....Dec. 244
Houghton & Co., E. F.:
Selecting Drawing Compounds for Press Work.....Apr. 157
Some Points to be Considered in Selecting Drawing Lubricants.....June 176
Howard Tool Adjustment Block.....July 218
Howes, Charles E., Personal of.....Jan. 212-B
Hubs, Fixture for Spot-facing Ends of Lever ..... Mar. 182
Hughes, Theodore G., Personal of.....May 234
Hullinger, O. M., Personal of.....Oct. 234
Humidity a Cause of Trouble in Abrasive Wheel Drying Rooms.....Oct. 167
Humidity Recorder, G-E Automatic.....Aug. 220
Hunt, L. R.:
Electronic Equipment Facilitates Wire-rope Manufacturer ..... Jan. 171
Hurt, Allen, Personal of .....Feb. 240
Husemann, E. W., Personal of.....Apr. 244
Huston, Charles Lukens, Personal of.....Jan. 213-D
Hydratrol Lathe with Automatic Feed Regulator and Automatically Positioned Stops, Lehmann.....Mar. 190
Hydraulic Circuit in Bending Machines. E. J. DeWitt and Harry S. Nachman.....June 149
Hydraulic Control, Sperry Miniature.....May 216
Hydraulic Cylinders, Anker-Holth Non-rotating ..... June 226
Hydraulic Machinery, Inc.:
Hy-Mac Machines for Broaching Split-line Bearings.....Oct. 201
Hy-Mac Press with Continuous Dial Feed and Automatic Work Ejector.....Dec. 201
High-pressure Superdraulic Pump.....Apr. 228
Hy-Mac Special Machine for Drilling, Spot-facing, Counterboring, and Tapping..July 204
Hydraulic Oils for Industrial Equipment. J. C. Van Gundy.....Aug. 158
Hydraulic Power Assemblies, Denison Packaged ..... Feb. 202
Hydraulic Press Mfg. Co.:
Huge High-pressure Die-casting Machine ..... Sept. 216
Forging with Closed Dies in Hydraulic Presses.....Feb. 176
Turbojector Molding Machine.....May 195
High-pressure Die-casting Machines.....June 203
Hydraulic Press, see Press
Hydraulic Units, John S. Barnes.....June 220
Hydro-Aire, Inc.:
Multi-way Selector Valves .....Aug. 210
"Hydrocast" Die-casting Machine.....July 203
Hydromatic Milling Machines, Cincinnati Plain and Duplex.....June 205
Hydropress, Inc.:
"Hydrocast" Die-casting Machine.....July 203
Hygiene Uses, "Tri-San"—A New Material for Industrial .....Sept. 207
Hy-Mac Machines for Broaching Split-line Bearings.....Oct. 201
Hy-Mac Press with Continuous Dial Feed and Automatic Work Ejector.....Dec. 201
"Hy-Mac" Special Machine for Drilling, Spot-facing, Counterboring, and Tapping.....July 204
Hypersonic Analyzer, Non-destructive Material Testing by the.....Jan. 184

I

Ideal Commutator Dresser Co.:
Super-sensitive Balancing Ways.....Sept. 230
"Air-Horse" Pneumatic Riveting Hammer ..... Mar. 199
"Air-Horse" Rotary File and Die Grinder ..... July 208
Imp Lo-Swing Automatic Lathe with Rotary Loader and Double-end Drive.....Feb. 196
"Impact Air Hammer" Units for Riveting and Piercing.....Apr. 216
Impact Values of Steel Castings for Use at Extremely Low Temperatures, High.....June 190
Imports, Export Trade Requires.....Oct. 228

Incentive Payment Plans, Practical Pointers on the Establishment of....Mar. 186
Incentive System, Results Obtained with the Lincoln ....Oct. 183
Incentive Wage Plans....Sept. 204
Independent Pneumatic Tool Co.:
Thor Pneumatic Impact Wrench ....June 226
Independent Research Committee on Cutting Fluids:
Annual Meeting Held in Detroit....Dec. 194
Indexing Device for Fixtures, Simple....May 184
Indexing Device, "Quadrill" Equipped with ....Dec. 228
Indexing Head, Cleveland....July 218
Indexing Machine for Milling, Drilling, and Tapping Motor Frames, Davis & Thompson Four-station....Apr. 205
Indexing-table Machine, Snyder Special Seven-station....June 212
Indexing Table Type Machine Tools, Zagar Collet for....Oct. 212
Indicators, Federal Small-size Dial....Aug. 224
Indicators for Checking Close Tolerances, "Decimatic"....May 212
Indium — A Metal Acquiring Industrial Significance ....June 151
"Ind-L-Way" Drill Grinding Fixtures, Improved ....Feb. 208
Induction Brazing of Carbide Tips to Tools ....Apr. 177
Induction Hardening Speeds up Lead-screw Production, Charles H. Parks and Dr. Joseph Libsch ....July 179
Induction Heaters Speed Shrink-fitting Operations, Standard-cycle ....Feb. 156
Induction Heating Applications in the Machine-building Industries....Aug. 181
Induction Heating, Brazing Tool Tips to Shanks by. T. A. Vernor and E. F. Adams ....Dec. 178
Induction Heating Corporation:
Master Induction Heating Coil with Interchangeable Inserts ....Nov. 215
Induction Heating Coil for Localized Hardening....Apr. 213
Induction Heating Equipment for Forging Operations, Automatic....Sept. 226
Induction Heating, Film on....Apr. 198
Induction Heating Coil for Localized Hardening....Apr. 213
Induction Heating Coil with Interchangeable Inserts, Master....Nov. 215
Industrial Cooperation is Essential to Engineering Progress....Mar. 174
Industrial Diamond Association of America:
Industrial Diamond Trade Association Formed ....Apr. 165
Industrial Mfg. Co.:
Improved "Ind-L-Way" Drill Grinding Fixtures ....Feb. 208
Industrial Oven Engineering Co.:
Heavy-duty Constant-speed, Constant-tension Winding Reel....Oct. 218
Industrial Progress Starts Endless Chain of Activity ....July 188
Industrial Progress, There are Unlimited Possibilities for ....June 186
Industrial Relations for Sound Industrial Progress, Sound....Jan. 169
Industrial Washing Machine Corporation:
Portable Industrial Washing Machine....Oct. 226
Industries, How Germany Built Up Its Manufacturing ....Dec. 180
Industry, Initiative and Enterprise are the Cornerstones of ....Dec. 188
Industry is Still Operating Under a Dictatorship....Apr. 192
Industry to Victory, We Should Not Forget the Contribution of....Sept. 192
Industry Vital to Prosperity? Why Does Government Hamper an....June 186
Inflation, A Manufacturer-economist Appraises Labor's Trend Toward ....Mar. 160
Inflation? Do "the Blind Lead the Blind" into the Ditch of....May 180
Ingram, R. F., Personal of....Nov. 230
Inhibitors Developed for Inside Storage Protection, Rust ....Dec. 197
Injection Molding Machines....May 194
Injection Press, Van Dorn Plastics....June 224
Inks for Marking Plastics, Rubber, and Insulated Wire ....Aug. 199
Inserts for Holding Devices, Kennametal Gripping....July 224
Inspection Employed by Ford, Magnetic....Sept. 171
Inspection in Modern Industry, Magnetic. Earle D. Wilcox....Sept. 179
Inspection Machine, Automatic....Oct. 214
Inspection Methods Under Buick's New Program. Charles N. Ofield....Feb. 139
Inspection on Jig-boring and Jig-grinding Machines. J. R. Moore....Apr. 160
Inspection Operations, Multiple Height Gage Simplifies Lay-out and....Sept. 187
Inspection Plate, Ex-Cell-O Taper ....July 206
"Installograph" Drawing ....Dec. 167
Instrumaster Industries:
Aids in Making Three-dimensional Drawings ....May 224
Instrument Parts Corporation:
Meehanite for Screw Machine Cams....Dec. 195
Instrument Society of America:
Organization Meeting Held in Pittsburgh ....Jan. 189
Insulating Board Made of Non-cotton Cellulose, Improved Electrical ....Nov. 175
Insulation for High Temperatures, Silicone ....June 173
Intermittent Motion for Changing Timing Interval for Air-valve Functioning....May 182
Intermittent Motion Mechanism, Irregular. L. Kasper ....May 181
International Nickel Co., Inc.:
Hardened Steel Rollers....Oct. 194
Machine-tool Cast Iron....Dec. 195
Outstanding Operations in Processing of Nickel and Nickel-alloy Products....Feb. 164
Manufacture of Welding Electrodes....Apr. 152
High-strength Castings ....June 192
Production of Clad Steels by Rolling....July 158
Material for High-strength Clutch Plate ....Aug. 194
Nitriding Stainless Steels....Aug. 234
Inventors from Infringements by U. S. Government, Protecting Rights of. B. E. Shlesinger ....Sept. 167
Iron and Steel, Color Parkerizing Increases Corrosion Resistance of....July 197
Iron, see Wrought, Cast, Malleable, etc.
Iron with Carbide Cutters, Milling Cast....Sept. 153
Irregular Intermittent Motion Mechanism. L. Kasper....May 181
Irvington Varnish & Insulator Co.:
Heat-resisting Plastic Tubing Has Improved Flexibility ....Mar. 185
Flexible Diaphragm Cloth Resists Temperature Change....July 197
Island Equipment Corporation:
Sectionalized Assembly or Production Line ....May 167

J

J & S Tool Co.:
Radius- and Angle-dresser....Nov. 222
Jack & Heintz, Inc.:
Electronic Gages ....Dec. 206
Cast-aluminum Automobile Engine with Horizontal Cylinders ....Apr. 191
Jackish & Spanik:
Self-oiling Lathe Center....May 201
Jackman, Edwin T., Personal of....Apr. 244
Jacobs Mfg. Co.:
Rubber-Flex Drill Chucks....Nov. 218
Jacobsen, E. R., Personal of....Mar. 236
"Jam-Proof" Tap-holder, Barnaby....Mar. 210
Janette Mfg. Co.:
Speed Reducers with Double Planetary Gear Units....Dec. 228
Jansson, A. W.:
Spindle-control and Collet-operating Mechanism for Screw Machines....July 189
Jappel, Frank O., Personal of....July 240
Jennings, Charles H., Personal of....Jan. 212-B
Jensen, Otto M., Personal of....Jan. 212-D
Jessop Steel Co.:
New Composite Steel for Knives and Blades ....Nov. 174
"Jet" Drill for High-speed Production Drilling ....Mar. 218
Jet Engine Developed to Drive Planes on Long Flights, Torpedo-shaped ....May 178
Jig Borer, New Sip High-precision....July 202
Jig-boring and Jig-grinding Machines, Inspection on. J. R. Moore....Apr. 160
Jig-boring and Jig-grinding Machines Promote Interchangeability in Toolmaking. J. R. Moore ....Mar. 163
Jig-boring Machine Equipped with Large Built-in Rotary Table, Pratt & Whitney....Oct. 216
Jig Boring Machine, Master Model Cleereman ....Mar. 198
Jig Designed for Drilling & Bellcrank Lever Having a Forked Arm....Jan. 188
Jig for Drilling Cross-pin Holes in Shafts and Studs....Feb. 212
Jig for Drilling Sleeve Flanges....June 196
Jig for Drilling Small Levers, General-purpose ....Aug. 197
Jig for Drilling, Tapping, and Spot-facing the Shank End of a Small Forging....Mar. 182
Jig for Grinding Blades of Carbide Milling Cutter ....Apr. 232
Jig for Producing Semicircular Groove, Drill ....May 184
Jig for Swivel Bracket, Drill....June 189
Jig with Half-bushing Guide for Drill, Slot-drilling. H. Moore....Apr. 195
Jigs and Fixtures Designed for Milling Gear-pump Body Cavities....Apr. 196
Jigs, Drillet Box....Mar. 210
Jigs, "Kam-Grip" Drill....May 199
Jigs, Masonite Die Stock Used for Drill....Nov. 165
Jigs, Reinforced Plastic Resin Tested for Tooling....July 196
Jigs to Table, Slides for Holding Drill....July 195
Jigs, Woodworth "Miniature Cone-Lok"....May 216
Job Evaluation Methods Discussed at the A.S.M.E. Spring Meeting....May 191
Jobs, see also Employment
Johnson, C. F., Personal of....Jan. 212
Johnson Machine Co., Carlyle:
Safety Clutch with Automatic Overload Release....Jan. 198
Johnson, Ray P., Personal of....Dec. 242
Johnson, Stanley E., Personal of....Sept. 246
Joints, "White Line" Precision-made Universal ....May 222
Jones, E. H., Obituary of ....Feb. 245
Jones, Frank W., Personal of ....Jan. 211-C
Jones & Lamson Machine Co.:
Automatic Self-opening Die-heads and Ground-thread Flat Rolling Dies....June 208
Jones & Laughlin Steel Corporation:
Ten Tons of Steel Handled by One Man Aided by Battery-powered Ram Type Truck..July 175
Jones, Lewis A., Personal of ....Mar. 236
Jordanoff Corporation:
Visual Education by Means of Drawings, Exploded Views, and Transvision....Mar. 180
Junk, John P.:
Die Equipped with Three Tool Bits for Notching Flanged Shell ....Nov. 181
Juran, Joseph M., Personal of ....Jan. 212

K

"Kam-Grip" Drill Jigs ....May 199
Kane, William E., Obituary of ....Dec. 250
"Karbo Kasing" Process Simplifies Salt Removal ....Apr. 201
Kardevan, Frank C., Personal of ....Feb. 245
Kasper, L.:
Intermittent Feeding Mechanism Designed to Operate Two Slides from One Cam ....Sept. 193
Spring-actuated Receding Guides for Locating Work in Coining Die ....Dec. 192
Die for Forming Irregular-shaped Spring ....Jan. 185
Interrupted Rotating Motion with Quick Take-up Action ....Feb. 189
Irregular Intermittent Motion Mechanism ....May 181
Kaydon Engineering Corporation:
Conical Roller Thrust Bearings ....Mar. 211
Unusual Type of Narrow Large-diameter Ball Bearings ....Apr. 194
Kearney & Trecker Products Corporation:
Milwaukee "Autometric" Boring Machine ....Oct. 201
Combination Milling and Boring Machine ....Jan. 195
New Line of Milling Machines ....Apr. 209
Keene Valley Engineering Co.:
Form Tools and Adapter for Small-lot Runs ....Feb. 218
Keller, Fritz L.:
Simple Method of Duplicating Cam Surfaces on a Surface Grinding Machine....July 194
Kelley, J. Robert, Personal of ....Mar. 235
Kellogg Co., M. W.:
Some of the Peaceful Gains from the Atomic Bomb Research ....Oct. 228
Kells, Charles F., Personal of ....Nov. 230
Kelly, Vincent R., Personal of ....Apr. 244
"Kengrips"—Durable Gripping Inserts for Holding Devices ....July 224
Kennametal Inc.:
Lathe File ....Sept. 236
Demonstration of Kennamilling ....Dec. 179
Universal Face-milling Cutters ....Mar. 218
Gripping Inserts for Holding Devices....July 224
Disk Type File ....Aug. 218
Kennamilling, Demonstration of ....Dec. 179
Kerr, A. J., Personal of ....Apr. 252
Kerrigan, Walter C., Personal of....Aug. 240
Kett Tool Co.:
Floating Tool-holder ....Dec. 222
"Key-Lok" Brake Blocks ....Sept. 185
Kilburn, Warren J., Personal of....Nov. 224
Kile, Miss G. D., Personal of....Nov. 228
Killfoile, Daniel J., Personal of ....May 234
Kindt-Collins Co.:
Lubricant Improves Action of Metal-cutting Saw Blades ....Sept. 207
Metal Dowels for Patterns and Core-boxes ....July 209
Kirksite Dies and Stretch Blocks Employed in Bus Building. R. B. Stubbs....Dec. 168
Klaus, Charles E., Personal of ....July 238
Klein, J. L., Personal of ....July 246
Klett, Fred F., Personal of ....Oct. 238
Klingeman, William E., Personal of....Nov. 228
Knapp Co., James H.:
"Pre-Selectric" Power Feeder for Deep-hole Drilling ....Oct. 209
Kneen, H. F., Personal of ....Dec. 246
Knight, Oscar A., Personal of ....Feb. 234
Knives and Blades, A New Composite Steel for ....Nov. 174
Knox, William E., Personal of ....Aug. 247
Knurling Fixture, Automatic Hopper-fed. Alex S. Arnott ....Oct. 189
Knurling Tool, Boyar-Schultz ....Oct. 226
Knurling Tools, Carboloy Pins Reduce Maintenance of ....May 167
Knutson, S. B., Personal of ....Apr. 252
"Kodak Green Scribing Plate" ....Aug. 226
Kofmehl, Paul, Personal of ....Sept. 246
"Kolene" Cleaning Process that Facilitates Bonding of Meehanite to Babbitt....July 196
Kordenbrock, John E., Obituary of....June 248
"Kotol" Coating for Protecting Metal Products ....Aug. 199
K. P. Chemical Co.:
Cleaner Suitable for Use in Any Type of Water ....Apr. 200
Kraus, Charles L., Personal of ....June 238
Kraus, J. J., Personal of ....Sept. 242
Kraut, H. B., Personal of .... Sept. 250, Oct. 242
Kraut, Lieutenant Colonel Ralph J., Personal of ....Oct. 242
Krieger Color & Chemical Co.:
Black Plastic Dye Sets to Permanent Ebony Shade ....Mar. 185
"Kriegr-O-Dip" Black Plastic Dye Sets to Permanent Ebony Shade ....Mar. 185
Kriston—A Non-flammable Thermosetting Plastic ....Dec. 196
Kronenberg, Dr. M.:
Initial Contact of Milling Cutter and Workpiece ....Oct. 149

L

L. A. B. Corporation:
Vibration Test Table Used to Shake Out Faults of New Designs....Nov. 167
Labor and Management, A Common-sense Program for ....Feb. 182
Labor Efficiency Affected by Draft....Sept. 178
Labor Leaders Prevent Full Employment by Present Policies, Government and ....May 187
Labor Policy to Minimize Industrial Strikes, A National ....Apr. 169
Labor Relations Institute:
Practical Pointers on the Establishment of Incentive Payment Plans ....Mar. 186
Labor Unrest is Genuine Worker-Management Cooperation, Only Remedy for....Jan. 156
Labor's Trend Toward Inflation, A Manufacturer-economist Appraises ....Mar. 160
Lackey, W. Harrison, Personal of ....Dec. 248
Ladwig, Arthur A., Personal of ....Mar. 238
Lagerfeldt, Ralph G., Personal of....Dec. 242
Lake Erie Engineering Corporation:
Giant 6000-ton Hydraulic Press with Total Height of 43 Feet ....Sept. 188
Bending and Forming Press ....Mar. 206
Lamb, Captain Carl J., Personal of....June 242
Laminated Materials or Measuring Sheet Thickness, Gage for Inspecting Bonds of....May 224
Lancing Facilitates Scrapping of Huge Castings, Oxygen ....Nov. 156
Landex Improved Die-head ....Oct. 222
Landgraff, Ed T., Personal of ....May 239
Landis, G. G., Personal of ....Dec. 246
Landis Machine Co.:
Special Fixture for Threading Fuse Adapters on Landmaco Machine ....Oct. 212
Landex Improved Die-head ....Oct. 222
Special Work-holding Fixture for Landmaco ....Nov. 215
Lanco Hardened and Ground Die-heads....Apr. 213
Centerless Thread Grinding Machine....June 200
"Centering-Throat" Chasers ....July 212
Landis Tool Co.:
Universal Grinding and Tool Sharpening Machine ....Sept. 224
Hydraulic Crankpin Grinding Machine for Heavy Diesel-engine Crankshafts .... Jan. 197
Landis, W. C., Personal of ....June 247
Landon, Professor R. D., Personal of....Dec. 246
Landreth, R. N., Personal of....Nov. 238, July 238
Lapping Compound, Michigan Abrasive....Oct. 214
Lapping Machine, Centerless ....June 222
Lapping Machine, Spitfire Roller ....Jan. 209-C
Lapping Machine, Wickman-Neven Bench Grinding and ....Aug. 211
Lapping Powder and Powdered Metal for Setting Diamonds, Diamond ....Jan. 201
Lapping Radius-formed Pivot Bearings, Improved Methods for ....Nov. 168
Lapping Tool, Reich Center-....May 222

La Rose & Associates, W. T.:
Thermall High-frequency Heating Unit..May 196
Larsen, George R., Personal of ..... Jan. 212
Laskey, Frank J., Personal of ..... Oct. 240
Lassen, E. U., Personal of ..... Dec. 248
Lathe Attachment, "Dunamatic" ..... May 206
Lathe, Barrett Portable ..... Oct. 218
Lathe by Relocating Motor and Countershaft, Reducing Vibration in a. William Henry Morrison ..... Sept. 194
Lathe Center, J & S Self-oiling ..... May 201
Lathe, Centering Device Used in Positioning Work Drilled in ..... June 196
"Lathe Converter" Changes a Lathe into an All-around Machine Shop ..... Mar. 176
Lathe, Crozier Vacuum-grip Speed.....July 218
Lathe File, Kennametal ..... Sept. 236
Lathe for Small Work, Lodge & Shipley Automatic ..... Oct. 199
Lathe, Hardinge Precision ..... Nov. 198
Lathe, LeBlond Rapid-production ..... July 201
Lathe, Levin Precision Bench ..... Sept. 222
Lathe, Multi-purpose Speed ..... Dec. 220
Lathe, South Bend ..... Sept. 238
Lathe Tools to Eliminate Chatter, Grinding. C. W. Christiansen ..... May 174
Lathe, Turret, see Turret
Lathe, Vari-speed Bench ..... Mar. 196
Lathe, Wickes Automatic Crankshaft Turning ..... Mar. 196
Lathe, Wickes Automatic Multiple Crankpin Turning ..... June 213
Lathe with Automatic Feed Regulator and Automatically Positioned Stops, Lehmann Hydratrol ..... Mar. 190
Lathe with Rotary Loader and Double-end Drive, Imp Lo-Swing Automatic ..... Feb. 196
Lathes, Lawrenz "Thread Faster" Attachment for ..... June 230
Lathes, LeBlond Automatic Crankshaft.....Apr. 202
Lathes, Multi-diameter Turning Attachment for ..... June 210
Lathes, New and Improved: Monarch.....Mar. 187
Latrobe Electric Steel Co.:
Even Distribution of Free Carbides Improves High-speed Steels ..... Aug. 198
Lawrenz "Thread Faster" Attachment for Lathes ..... June 230
Lawson, S. C., Personal of ..... Sept. 250
Lay-out and Inspection Operations, Multiple Height Gage Simplifies ..... Sept. 187
Lay-out, Scribing, and Measuring Work, Radii Attachments for ..... Sept. 230
Lay-outs, Three-dimensional Plant ..... Sept. 194
Lead-screw Production, Induction Hardening Speeds up. Charles H. Parks and Dr. Joseph Libsch ..... July 179
Lear, Inc.:
Universal Motors ..... Dec. 224
Leary, Robert G., Personal of ..... Apr. 246
LeBlond Machine Tool Co., R. K.:
Automatic Crankshaft Lathes ..... Apr. 202
Motor-head Rapid-production Lathe .... July 201
Leckie-Ewing, Peter H. W. B., Personal of ..... Oct. 242
"Lectro-Clad" Internal Plating Process Makes Steel Pipe Corrosion-resistant ..... Jan. 191
Lee, T. L., Personal of ..... Feb. 238
Lehmann, George P., Personal of ..... July 240
Lehmann Machine Co.:
Unusual Machine Performs Many Varied Operations ..... Nov. 157
Hydratrol Lathe with Automatic Feed Regulator and Automatically Positioned Stops ..... Mar. 190
Lehr, Charles E., Personal of ..... Nov. 230
Leigh High-speed Flexible-shaft Grinder..June 230
LeMaire, H. G., Personal of ..... Mar. 235
LeMaire Tool & Mfg. Co.:
Heavy-duty Vertical Drilling Machine....Nov. 210
Heavy-duty Hollow-milling Machine ..... Jan. 204
Special Wheel-cylinder Drilling, Reaming, Boring, and Tapping Machine.....Mar. 204
LeMay, Henry L., Personal of ..... Apr. 244
Lempco Products, Inc.:
Precision Anti-friction Die Sets ..... Mar. 195
Lennox, George A., Personal of ..... Aug. 238
Lepel High Frequency Laboratories:
Induction Hardening Speeds up Lead-screw Production ..... July 179
Lester-Phoenix, Inc.:
Improved Die-casting Machines ..... Mar. 193
Injection Molding Machines ..... May 194
Levin & Son, Inc., Louis:
Precision Bench Lathe ..... Sept. 222
Lewis-Shepard Products, Inc.:
Improved "Handy-Hoister" ..... Feb. 213
Libsch, Dr. Joseph:
Induction Hardening Speeds up Lead-screw Production ..... July 179
Libsch, Joseph F., Personal of ..... May 239
Lidkoping Centerless Grinding Machine....Feb. 203
"Lifetime" Gage-blocks, DoAll ..... Feb. 222
Light Metal Machinery, Inc.:
Die-casting Machine Designed for Automatic Operation ..... Nov. 208
Light, Swivelier Grounded Work ..... Sept. 240
Lightner, Ralph H., Personal of ..... May 240
Lightronic Gage-head ..... July 207
Ligon, W. D., Personal of ..... May 239
Lincoln Arc Welding Foundation, James F.:
$200,000 Arc-welding Award Program Announced ..... June 183
Lincoln Electric Co.:
Under-water Welding Photographed for First Time ..... Oct. 148
Results Obtained with Lincoln Incentive System ..... Oct. 183
Improved Electrode for High-tensile Steels ..... Oct. 206
Gear Production Problems Solved by Automatic Welding ..... Nov. 153
"Fleet Arc Jr." Welder ..... Dec. 208
Only Remedy for Labor Unrest is Genuine Worker-Management Cooperation.....Jan. 156
Fiftieth Anniversary Celebrated ..... Jan. 210
Welder with Diesel Engine Drive.....Feb. 201
Improved Electrodes for Hard Facing....Mar. 199
Portable "Shield-Arc Junior" Welder..Mar. 207
Improved Stainless-steel Electrodes .... Apr. 205
"Lincolnweld" Process Welder ..... Apr. 220
Lincoln Park Industries:
Tungsten-carbide Rotary Files ..... Dec. 230
Cemented-carbide Reversible-wire Plug Gages and Thread-measuring Wires ..... Apr. 224
Lindblade, George A., Obituary of.....June 248
Linde Air Products Company, The:
Oxweld C-45 Heavy-duty Machine-cutting Blowpipe ..... Oct. 212
Teeth of Rack Flame-cut to Shape.....Oct. 230
Oxygen Lancing Facilitates Scrapping of Huge Castings ..... Nov. 156
Oxweld-Unionmelt Machine Carriage.....Jan. 201
Automatic Welding Process Increased Production Threefold ..... Feb. 184
Three Unionmelt Machines Weld Differential Housing to Axle Assembly for Trucks ..... Mar. 162
Oxweld Shape-cutting Machine ..... May 196
Flux-coated Bronze Welding Rods ..... May 224
Cutting Through 24 Inches of Steel....Aug. 187
Liner Fabric Permits "Breathing," Synthetic Waterproof Packing ..... Mar. 184
Linxweiler, Carl:
New Crush-dressing Applications ..... Jan. 143
Lipe-Rollway Corporation:
Pneumatic Bar Stock Feed ..... Mar. 214
Lippincott, Walter H., Personal of.....Aug. 236
Liquid Pressure, Instrument for Accurately Measuring Gas or ..... Oct. 187
Loading Chart Improves Truck Maintenance, Safe ..... June 168
Locating Work in Coining Die, Spring-actuated Receding Guides for. L. Kasper.....Dec. 192
Locke Gage Co.:
Extra Clearance Provided at the Roots of Thread Ring Gages.....Jan. 192
Lockheed Aircraft Corporation:
Magnetic Inspection in Modern Industry ..... Sept. 179
Locomotive-link Grinding Machine, Newton ..... Jan. 194
Lodge & Shipley Machine Tool Co.:
Duomatic Lathe for Small Work ..... Oct. 199
Loengard, Richard O., Personal of.....Sept. 244
Logansport Machine Co., Inc.:
"Rotocast" Hydraulic Cylinders.....Dec. 224
Air Regulating, Filtering, and Lubricating Unit ..... Jan. 204
"Air-Draulic" Cylinders ..... May 212
Correction—"Air-Draulic" Cylinders....June 191
Lord, Thomas, Personal of ..... Aug. 247
Lo-Swing Automatic Lathe with Rotary Loader and Double-end Drive ..... Feb. 196
Lotz, W. P., Personal of ..... Nov. 230
Lovejoy Flexible Coupling Co.:
Double-Flex Coupling ..... July 222
Lo ejoy Tool Co., Inc.:
Improved Slotting Cutter ..... May 197
Lubricant Developed for High-speed Chain Conveyors ..... Jan. 190
Lubricant Improves Action of Metal-cutting Saw Blades ..... Sept. 207
Lubricant in Piston-forging Operation Has High Flash Point ..... Feb. 174
Lubricant Lengthens Drill Life by Reducing Breakage, New ..... Nov. 175
Lubricants for Reaming; Speeds, Feeds and ..... Aug. 157
Lubricants, Some Points to be Considered in Selecting Drawing ..... June 176
Lubricating Unit, Logan Air Regulating, Filtering, and ..... Jan. 204
Lubrication Pump, McIntyre Pressure.....Nov. 200
Lubrication Pump, McIntyre Pressure.....June 203
Lubrication, Silicone Greases for High- and Low-temperature Bearing ..... Feb. 194
"Lubrigard" Safety Device, Gemco Shaper with ..... Feb. 202
Lucas-Milhaupt Engineering Co.:
Parallel-angle Magnetic Vise ..... Dec. 230
Luce, Dr. Alexander W., Personal of.....Aug. 240
Lucite Transparent Casing for Duplex Pipeline Strainer ..... Aug. 199
Lukens Steel Co.:
Steam Platens Produced by Welding..Sept. 178
What the Designer Should Know About Welded Machinery Parts:
1 ..... Jan. 157
2 ..... Feb. 167
Production of Clad Steels by Rolling....July 158
Lynde, L. E., Personal of ..... May 234
Lyon Metal Products, Inc.:
"Packaged" Line of Roller Conveyors....May 222

Mc

McClain, Donald, Personal of.....Dec. 242
McClung, Jr., E. R., Personal of ..... Apr. 252
McColl, Robert B., Personal of.....Nov. 228
McCormick, W. H., Personal of ..... Oct. 240
McDermond, C. C., Personal of ..... June 238
McDonald, Daniel E.:
Gage for Checking Special Screw Threads by Single-wire Method ..... Oct. 190
Instrument for Checking Bore Diameters in Long Cylinders ..... Dec. 192
McElgin, James:
Selecting Drawing Compounds for Press Work ..... Apr. 157
McEntee, Edward B., Personal of.....Sept. 242
McIntyre Co.:
Tool-room Precision on a Mass Production Basis ..... Oct. 139
Pressure Lubrication Pump ..... Nov. 200
Light-weight Rotary Pumps ..... Jan. 208-B
Pressure Lubrication Pump ..... June 203
McKenzie Engineering Co.:
Chip Separator for Screw Machine Products ..... July 205
McLean, Joseph W., Obituary of ..... Apr. 254
McPherson, H. E., Personal of ..... Feb. 240
McWorkman, Delamar, Personal of ..... Apr. 251

M

MacArthur, Henry E., Personal of ..... Sept. 250
Macauley, Alvan, Personal of ..... Apr. 244
MacCutcheon, A. M., Personal of ..... Aug. 242
MacFayden, F. R., Personal of ..... May 239
MacGlashan, Jr., W. F.:
Automatic Back-gear Shifter ..... Aug. 193
Machine Design, Ingenious Applications of Steel Balls in ..... Oct. 168
Machine Shop, A Model One-man ..... Feb. 156
Machine Shop Keeps Island-based Planes in the Air, Floating ..... Sept. 175
Machine Shop, Portable ..... Apr. 185
Machine-tool Cast Iron ..... Dec. 195
Machine Tool Castings for Anti-friction Bearings, Boring ..... Apr. 179
Machine Tool Control, Bullard Man-Au-Trol—A Completely Automatic ..... Nov. 190
Machine Tool Electrification Forum, Westinghouse Stages Its Tenth Annual ..... May 179
Machine Tool, Giddings & Lewis Multiple-purpose ..... Apr. 210
Machine Tool, Lehmann Multiple-operation ..... Nov. 157
Machine Tool Manufacturers to Aid in Industrialization of China ..... Nov. 178
Machine Tool Scale Models and Templets for Plant Lay-outs ..... Aug. 175
Machine Tools, A User Enumerates Future Requirements for ..... June 187
Machine Tools, How to Buy Surplus.....Apr. 170
Machine Tools, How to Deal with Surplus ..... Jan. 155
Machine Tools, Present-day Motor Drives and Other Electrical Equipment for. G. A. Caldwell ..... June 164
Machine Tools, Recommendations by Machine Tool Dealers on Surplus ..... Jan. 161
Machine Tools, Standardization of Electrical Equipment for. R. H. Clark ..... Jan. 176
Machine Tools to Work, Putting Surplus..Dec. 176
Machines for Demonstration Rooms in Trade Schools, Surplus ..... Jan. 179
Machinery, Determining the Base Prices of Used ..... May 179
Machining Costs to a Minimum, Governing Factors in Holding ..... Aug. 185
MacMillin, Howard F., Personal of ..... July 238
Macomber, Kenneth N., Personal of ..... June 240
Madco Products, Inc.:
Grinding Wheel Dresser and Lathe Angle-plate ..... Nov. 212
Madison-Kipp Corporation:
"Featherweight" Series of Portable Air Grinders ..... Feb. 199
Magazine-feed Attachment for Centerless Grinder, Automatic ..... Oct. 185
Magnesium, Deep-drawing of. Ralph G. Gillespie ..... Mar. 145
Magnesium, Heat-resistant Synthetic Rubber for Forming ..... Jan. 181
Magnesium, Portable Equipment will Provide Expanding Market for ..... Oct. 157
Magnesium, Relative Cost of ..... Nov. 182
Magnesium Sheets, Furnace for Preheating ..... Jan. 208-B
Magnesium, The Forging of. Arnold L. Rustay and Franklin B. Rote ..... June 141
Magnesium Used as a Substitute for Wood ..... Feb. 187
Magnet for Removing Iron Particles from Plastics, Eriez Permanent ..... May 208
Magnet Materials Announced by General Electric, New Permanent- ..... July 236
Magnetic Chuck, see Chuck
Magnetic Contactor, Westinghouse.....Jan. 208-B
Magnetic-field Gage for Magnetic-particle Testing, G-E ..... Aug. 208
Magnetic Hardness Tester for Small Ferrous Metal Parts ..... Feb. 198
Magnetic Holding Devices, Inc.:
Heavy-duty "Body Flo" Magnetic Chuck ..... July 212
Magnetic Inspection Employed by Ford....Sept. 171
Magnetic Inspection in Modern Industry. Earle D. Wilcox ..... Sept. 179
Magnetic Shop Floor Sweeper ..... Nov. 178
Magnetic Vise, Parallel-angle ..... Dec. 230
Magnetometer, Oil Exploration from Air Made Possible by Airborne ..... July 227
Mahan, S. D., Personal of ..... Dec. 246
Male, Lewis J., Personal of ..... Nov. 228
Management, A Common-sense Program for Labor and ..... Feb. 182
Management-union Corporation, a Step toward Real ..... Aug. 188
Man-Au-Trol—A Completely Automatic Machine Tool Control ..... Nov. 190
Mandel, H., Personal of ..... May 232
Mandrel with Eccentric Sleeve, Expanding ..... Jan. 208-B
Mandrel, Young Expanding ..... Feb. 222
Manganese, Manodyz Process for ..... Jan. 154
Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.; New Type of Brake Blocks ..... Sept. 185
Manodyz Process for Manganese ..... Jan. 154
Manton, William H.:
Sine Bar with Adjustable Blocks.....Mar. 183
Manufacturers Engineering Service, Inc.:
"Kam-Grip" Drill Jigs ..... May 199
Manufacturing Methods Must be Devised to Compensate for Higher Wages, Better..June 197
Manufacturing Plant—Mass Production Shop of the Future, The Automatic. Erik Oberg ..... Feb. 149
Manzer, Clifford M., Personal of ..... Aug. 238
Marion Electrical Instrument Co.:
Induction Heater for Production Soldering ..... Mar. 204
Marion, William H., Personal of ..... Mar. 236
Marking Machine, Noblewest High-speed ..... Jan. 205-A
Marking Tools and Metal Parts, Equipment for ..... Oct. 216
Markley, Frank R., Personal of ..... Mar. 236
Marlin-Rockwell Corporation:
Deburring Operation Speeded 400 Per Cent by Power Brushing ..... Mar. 171
Martin Co., Glenn L.:
Gage for Inspecting Bonds of Laminated Materials or Measuring Sheet Thickness ..... May 224
Convenient and Ingenious Crimping Tool ..... July 168
Training Draftsmen ..... July 173
Mason, Jr., R. W., Personal of ..... Aug. 238
Masonite Corporation:
Masonite Die Stock Used for Drill Jigs ..... Nov. 165
Massie Mfg. Co.:
Cleaning Compound for Flexible Abrasives and Metal Files ..... Aug. 198
Master Gauge Co.:
Tantung Thread Plug Gages ..... Oct. 224
Master Mfg. Co.:
The "Lathe Converter" Changes a Lathe into an All-around Machine Shop....Mar. 176
Material-handling Racks, Portable Automatic ..... June 217
Material Handling Society:
Society Formed at Meeting in Pittsburgh ..... Dec. 160
New Officers Elected ..... Mar. 220
Materials, Condensed Review of Some Recently Developed ..... Oct. 173
Mathematical Problem. John Homewood..Oct. 194
Matthias, Lynn, Personal of ..... Nov. 233
Mauk, A. K.:
Improved Flux for Gas-welding Aluminum ..... Jan. 191

Maust, Irving C., Personal of ..... June 238
"Maxipres" Developed for Production of Heavy Precision Forgings, Giant.....Sept. 218
"Maxitorq" Release Clutch, Overload.....Jan. 198
Mead, James M., Personal of ..... Feb. 238
Mead Specialties Co.:
Air-actuated Collet ..... Nov. 215
Combination Three- or Four-way Air Valves ..... Feb. 222
"Impact Air Hammer" Units for Riveting and Piercing ..... Apr. 216
Pneumatic Column Press ..... May 198
Measuring Apparatus, "Sip" Profile Projector and Universal ..... June 201
Measuring Gas or Liquid Pressure, Instrument for Accurately ..... Oct. 187
Measuring Wires, Van Keuren Carboloy Gear- ..... June 226
Mechanics, Correspondence Course in .... June 168
Mechanism Contest, Prize Winners in Ingenious ..... July 192
Mechanism for Controlling Cutter-head Slide of Automatic Cam-generating Device, Rotating Disk-and-pin, Charles Golosman....Aug. 189
Mechanism for Feeding Parts from a Stack, Reciprocating Slide ..... Feb. 190
Mechanism, Irregular Intermittent Motion. L. Kasper ..... May 181
Mechanisms, Five Hundred Dollars in Prizes for Articles on Ingenious....Feb. 157, Apr. 156
Mech-Art Products Corporation:
Hydraulic Straightening Press ..... Dec. 220
Meehanite for Screw Machine Cams.....Dec. 195
Meehanite Metal Corporation:
Motion Picture on Meehanite Castings..Mar. 167
Meehanite Permanent Molds ..... Sept. 240
Meehanite to Babbitt, Cleaning Process that Facilitates Bonding of ..... July 196
Meharg, Virgil E., Personal of ..... June 242
"Melamine Micarta" Panels for Control Boards ..... Oct. 232
Meletron Corporation:
Starbird Pressure-operated Switches .... Feb. 212
Melnitsky, Benjamin:
Obtaining Full Value from Power Hacksaw Blades ..... July 176
Merix Photo Co.:
Liquid Prevents Fog or Steam on Glass or Plastic Surfaces ..... Jan. 191
"Merry-Go-Round" Speeds Production of Tanks ..... Sept. 210
Messaros, F. C., Personal of ..... Apr. 252
Metal Congress and Exposition, National..Jan. 185
"Metal Master" Electrical Tools, Bradford ..... Apr. 213
"Metal Master," Thomas ..... Aug. 207
Metal Products Co.:
Deburring Tools ..... Apr. 230
Metal, Sheet-, see Sheet-metal
Metal Spinning by Modern Methods. Edwin Weiss ..... Nov. 141
Metal Spinning, The Technique of. Edwin Weiss ..... May 159
Metal Surfaces, Chemical Treatment of Highly Finished ..... July 166
Metal & Thermit Corporation:
New Murex Welding Electrodes.....Nov. 178
New Type of Thermit for Producing Steel Castings ..... Jan. 191
All-position High-tensile Electrodes....May 195
Metalite—A Featherweight Structural Material Developed in Aircraft Field.....Apr. 200
Metallizing Co. of America:
New Method of Salvaging Castings.....Sept 161
New Electric Welding Process Eliminates Residual Stresses ..... Dec. 190
Metric Screw Thread Standards ..... Dec. 238
Micreroloid Provides Protective Coating Against Corrosion ..... Nov. 175
Micrcrotex Coating for Plating Racks.....Aug. 198
Michaels, Harry R., Personal of.....Sept. 249
Michigan Abrasive Co.:
Abrasive Lapping Compound ..... Oct. 214
Michigan Chrome & Chemical Co.:
Micrcroloid Provides Protective Coating Against Corrosion ..... Nov. 175
Micrcrotex Coating for Plating-racks.....Aug. 198
Michigan Tool Co.:
Sine-line Lead Comparator for Helical Gears ..... July 202
Micro Metallic Co.:
Stainless-steel Parts Manufactured by Powder Metallurgy ..... July 196
Microbalancer—A Supersensitive Balancing Machine ..... Jan. 181
"Microgrind" Grinding Fluid, Water-soluble ..... May 218
Micromatic Hone Corporation:
Governing Factors in Holding Machining Costs to a Minimum ..... Aug. 185
Micrometer, Aireon Optical ..... May 220
Micrometer, Elgin Sapphire-tipped ..... July 222
Micrometer with Dial Indicator ..... Jan. 208
"Micro-Planer" Gage ..... Aug. 216
Microscope, Gaertner Toolmaker ..... Aug. 206
"Micro-Speed" Shaper with Variable-speed Drive ..... Mar. 210
Middleton, Ralph E., Personal of.....Dec. 239
"Midget Carburs"—Tungsten-carbide Rotary Files ..... Dec. 230
Mid-States Equipment Corporation:
Streamline Saw-gun ..... Feb. 224
"Zipper-Et" Portable Arc-welder ..... Apr. 230
Mill, see also End-mill, Hollow Mill, etc.
Miller, George E., Personal of ..... Feb. 240
Miller, Logan, Personal of ..... Feb. 236
Miller Tooling, New Film on Hand.....May 185
Milling and Boring Machine, Kearney & Trecker Combination ..... Jan. 195
Milling Cutters, see Cutters
Milling, Drilling, and Boring Machines....Jan. 199
Milling, Drilling, and Tapping Motor Frames, Davis & Thompson Four-station Indexing Machine for ..... Apr. 205
Milling, Drilling, Tapping, and Boring Machine, Giddings & Lewis Multi-purpose..Apr. 210
Milling Face-cam Profiles, Fixture for....Nov. 179
Milling Fixture for Airplane Parts. W. D. White ..... Nov. 180
Milling Gear-pump Body Cavities, Jigs and Fixtures Designed for ..... Apr. 196
Milling Known as "Kennamilling," New Methods of ..... Dec. 179
Milling Machine, Armor ..... May 199
Milling Machine, Cross Rotary Thread-....June 204
Milling Machine, Cross Special Boring, Facing, and Thread ..... Nov. 200
Milling Machine, Davis & Thompson Roto-Matic ..... Jan. 198
Milling Machine, Diamond ..... Aug. 202
Milling Machine, Gray Traveling-head.....Apr. 214
Milling Machine, Plan-O-Mill Thread.....Oct. 208
Milling Machine, Power Table Feed for Nichols ..... Feb. 208
Milling Machine, Slotting Marine Bearings on Special Planer Type ..... Apr. 151
Milling Machine, Van Norman Horizontal..Jan. 200
Milling Machine, Van Norman No. 2 Horizontal ..... Nov. 198
Milling Machine, Van Norman No. 3 Horizontal ..... Dec. 204
Milling Machine with a Lathe Tool, Facing Large Aluminum Castings on a. H. A. Schreiber.....Apr. 198
Milling Machine with Electronic Control for Power Feed, Fray ..... Sept. 234
Milling Machines, Cincinnati Improved....Aug. 201
Milling Machines, Cincinnati Plain and Duplex Hydromatic ..... June 205
Milling Machines, Cleaner Products Obtained by Exhausting Fine Chips from.....Aug. 172
Milling Machines, New Line of Kearney & Trecker ..... Apr. 209
Milling of Propeller-shaft Bearings, Rapid ..... Aug. 180
Milling of Tool Shanks Increases Production, Multiple. Earl Weaver ..... June 183
Milling Tool Shanks, Fixture for.....Mar. 181
Milling T-slots with Carbide-tipped Cutters ..... Jan. 187
Mills, Wallace C.:
Die Designed to Save Stock by Drawing Metal from Around Inner Blanked Hole ..... Sept. 202
Die for Forming Extruded Rivet in Sheet-metal Plate ..... Dec. 191
"Milpal" Machine Vise ..... May 210
Milwaukee Metal Spinning Co.:
Metal Spinning by Modern Methods....Nov. 141
The Technique of Metal Spinning.....May 159
Mine Safety Appliances Co.:
Portable Source of Heat for First-aid Use ..... July 175
"Miniature Cone-Lok" Jigs, Woodworth..May 216
Miniature Precision Bearings:
Super-light Miniature Ball Bearings....Mar. 220
Midget-size Angular-contact Ball Bearings ..... May 220
Models and Templets for Plant Lay-outs, Machine Tool Scale ..... Aug. 175
Modern Machine Tool Co.:
Radii Attachments for Lay-out, Scribing, and Measuring Work ..... Sept. 230
Modern Products, Ltd.:
"Modernair" Pneumatic Three-way Pilot Valve ..... Feb. 218
Modernair Corporation:
Cushion Type Cylinders ..... Aug. 222
"Modernair" Pneumatic Three-way Pilot Valve ..... Feb. 218
Moerman, N. A., Personal of ..... Dec. 244
Moffat, Lieutenant Colonel E. G.:
System for Handling Single-point Tools at Watervliet Arsenal ..... Mar. 161
Moffett, R. W., Personal of ..... Apr. 251
Mogul Cast-Seal Solution for Salvaging Castings ..... Sept. 161
"Mogul Dot-Weld" Process Eliminates Residual Stresses ..... Dec. 190
Mold Release Fluid and Compound Aid Rubber and Plastic Molding. Silicone ..... Mar. 184
Molds Fire-resistant, Compound Makes Foundry ..... Sept. 207
Molds, High Production with Carbide Nib..Oct. 230
Molds, Mechanite Permanent ..... Sept. 240
Molding Machine, H-P-M 'Turbojector.....May 195
Molding Machines, Injection ..... May 194
Molding Machines, Reed-Prentice ..... Jan. 196
Molding Presses for the Plastics Industries. P. Chartrand ..... Sept. 172
Molding, see also Patternmaking
Molding, Thermosetting Resins Developed for Impression ..... Sept. 206
Molybdenum, New Applications of ..... June 167
Molybdenum, Westinghouse Develops New Process for Producing ..... Feb. 195
"Mona-Matic" Lathe ..... Mar. 187
Monarch Machine Tool Co.:
New and Improved Monarch Lathes....Mar. 187
Monarch Uni-Point Radial Saw ..... Apr. 216
Money, Fred B.:
Double-acting Attachment Permits Deep Drawing on a Single-acting Press.....Aug. 195
Mono-ball Bearings and Spherical Bearing Rod Ends ..... Sept. 214
Monoset Cutter and Tool Grinding Machine, Cincinnati ..... May 194
Monsanto Chemical Co.:
"Thalid X500" Thermosetting Resin for Impression Molding ..... Sept. 206
"Thalid X-100" Plastic Substitute for Tung Oil in Sealing Aluminum Castings ..... Nov. 174
Montelth, A. C., Personal of..... Oct. 242
Moore, H.:
Slot-drilling Jig with Half-bushing Guide for Drill ..... Apr. 195
Moore, J. R.:
Jig-boring and Jig-grinding Machines Promote Interchangeability in Toolmaking ..... Mar. 163
Inspection on Jig-boring and Jig-grinding Machines ..... Apr. 160
Moore Products Co.:
Pneumatic Comparator Gage ..... Oct. 220
Moore, Richard F., Personal of ..... Nov. 226
Moore Special Tool Co., Inc.:
Set-up Blocks ..... June 217
Leaf Taper Gages for Measuring Hole Diameters ..... July 222
Moran, Thomas P., Personal of ..... Mar. 236
Moreland, H. D., Personal of ..... Feb. 234
Morgan, David W. R., Personal of.....Apr. 252
Morgan, Everett L., Personal of.....Feb. 236
Morrison, William Henry:
Reducing Vibration in a Lathe by Relocating Motor and Countershaft ..... Sept. 194
Morrissey, Ray, Personal of ..... Mar. 228
Morse III, Charles H., Personal of.....Dec. 239
Moser, John L., Personal of ..... Feb. 245
Moslo Machinery Co.:
New Electrode Coating Equipment with Improved Features ..... Sept. 189
Moss, Dr. Sanford A., Personal of.....Jan. 212
Mosthaf, E., Personal of ..... Apr. 246
Motch & Merryweather Machinery Co.:
Metal Cutting-off and Sawing Machines..May 197
Motion Pictures, Industrial:
"Golden Horizons" on Development of Copper-base Alloys ..... Oct. 232
"Meehanite Means Better Castings"....Mar. 167
"The Original Films of Frank B. Gilbreth" ..... Mar. 180
Theory and Practice of Gear Cutting Shown in Motion-picture Film.....Apr. 188
"Metal Magic" on Induction Heating....Apr. 198
Film Showing Procedure in Casting New Aluminum Alloy ..... May 173
"Hand Miller that Uses Its Head".....May 185
United States Government Educational Films ..... May 224
Film for Engineering Classes Showing Unusual Operations ..... June 151
Film on "Our Industrial Air Power".....June 168
"This is Resistance Welding".....June 182
Plastics Molding Film ..... Aug. 185
Motor Drives and Other Electrical Equipment for Machine Tools, Present-day. G. A. Caldwell ..... June 164
Motor, General Electric Enclosed Fan-cooled ..... May 218
Motor, Superdraulic Small-size, High-power Hydraulic ..... Aug. 211
Motor with Wide Speed Variation, Westinghouse Develops Direct-current ..... Jan. 210
Motors, Improved Grease for Ball and Roller Bearing ..... Dec. 196
Motors, Lear Universal ..... Dec. 224
Motors of Light Weight per Horsepower, Electric ..... June 194
Mounce, W. S., Personal of ..... Feb. 236
Mounting for Delicate Equipment, Shock-absorbing ..... Feb. 224
Muller, R. F., Personal of ..... Apr. 252
Mullestein, W. E., Personal of ..... Nov. 230
"Multi-Drill" Attachment, Commander.....Oct. 208
Multi-Flex Ducts for Air, Gases, and Powdered Material ..... May 172
Multiple-operation Machine Tool, Lehmann Special ..... Nov. 157
"Multi-Unit HydrOILic Power" Assemblies ..... Feb. 202
Mumford, Philip S., Personal of.....May 232
Munn, Jr., R. H., Personal of ..... Mar. 236
Munson, Jr., Lieutenant Commander C. S., Personal of ..... Mar. 235
Munton Mfg. Co.:
Self-contained Hydraulic Presses.....Dec. 222
Musselman, C. A., Obituary of ..... Feb. 245
Mycalex Applications, Improvements in Molding Technique Widen ..... Aug. 199

N

Nabb, D. A., Personal of ..... Dec. 242
Nachman, Harry S.:
Cold-bending of Pipe and Metal Shapes ..... Apr. 141
Tools for Use in Bending Machines.....May 188
The Hydraulic Circuit in Bending Machines ..... June 149
Designing Work for Bending ..... July 154
Nagel, Carl E., Personal of ..... Apr. 252
Nagle Brothers:
Equipment for Marking Tools and Metal Parts ..... Oct. 216
Nagle, Ted, Personal of ..... Mar. 230
Nase, Philip G., Personal of ..... June 242
National Acme Co.:
Recent Applications of the Thread-rolling Process ..... Dec. 161
Acme-Gridley Single-spindle "Chuck-Matic" ..... May 193
National Broach & Machine Co.:
Red Ring Internal Gear-shaving Machine ..... Oct. 214
National Bureau of Standards:
Proposed Revision of Simplified Practice for Grinding Wheels ..... Aug. 185
National Diamond Hone & Wheel Co.:
Using Diamonds for the Crush-forming of Grinding Wheels ..... Jan. 179
Diamond Lapping Powder and Powdered Metal for Setting Diamonds ..... Jan. 201
National Machine Tool Builders' Association:
Booklet Entitled "Machines, Prices, Jobs" ..... Nov. 222
Annual Meeting Held in Chicago ..... Nov. 222
New Officers of Association ..... Dec. 154
Spring Meeting Held in Atlantic City..May 186
National Machine Tool Co.:
Heinrich "Grip-Master" Vise ..... Jan. 209-A
National Metal Trades Association:
Annual Convention Held in Cleveland..Dec. 198
National Oil Products Co.:
Three Cutting-oil Bases with Wide Field of Application ..... Aug. 200
Naugatuck Chemical Division of United States Rubber Co.:
Plastic Coating for Protecting Metal Products ..... Aug. 199
Navy Public Relations Job, A Good.....July 187
Needle Bearings, A Manual on ..... Oct. 165
Neff, Elmer H., Obituary of ..... Mar. 238
Nelco Tool Co., Inc.:
Carboloy-tipped Twist Drills ..... Mar. 216
Carbide-tipped End-mill ..... July 214
Nelson, A. P.:
Machining Stainless-steel Valves ..... July 148
Neoprene, Results of Ten-year Aging Test of ..... June 176
Nessen, Walter F., Personal of ..... Feb. 234
Neu-Bart Stamping & Mfg. Co.:
Die Life Lengthened by the Use of Carboloy ..... Apr. 184
Neuhardt, Frederick H., Personal of.....Mar. 235
Neumann, Carl Samuel, Obituary of ..... Nov. 234
New England Carbide Tool Co.:
Carbide Die Increases Production of Motor Laminations ..... Oct. 232
Newcomer, William E.:
Improved Method of Brazing Carbide Tips to Shanks ..... Oct. 192
Newman, John M., Personal of ..... Jan. 212-D
Newpher, Charles R., Personal of.....Apr. 251
Newton Radius-link Grinding Machine.....Jan. 194
Nice Ball Bearing Co.:
New Line of Radial Ball Bearings.....Feb. 212
Nicholas, J. M.:
An Ex-prisoner-of-war Writes to MACHINERY ..... Apr. 199

Nichols-Morris Corporation:
Bemisine Dual-purpose Angle Dresser..Oct. 224
New Film on Hand Miller Tooling.....May 185
Nichols & Sons, W. H.:
Power Table Feed for Milling Machine..Feb. 208
Nicholson File Co.:
Rotakit Assortment of Files and Burrs Dec. 222
Nickel and Nickel-alloy Products, Outstanding Operations in Processing of ..... Feb. 164
Nickel-steel Tubing for Low-temperature Applications ..... Jan. 191
Nipar, John E., Personal of ..... Jan. 212-B
Nitriding Stainless Steels ..... Aug. 234
Noble & Westbrook Mfg. Co.:
Noblewest High-speed Marking Machine Jan. 205-A
Nopco 1009-C—A Cutting-oil Base with Wide Application ..... Aug. 200
Nordmark, C. G.:
Set-ups That Solved Nine Borizing Problems Jan. 162
Norris, Eugene W., Personal of ..... Jan. 212-D
Norsen, Thomas H., Personal of ..... Nov. 226
North American Aviation, Inc.:
Copper Furnace Brazing ..... Dec. 139
Northern Tool & Machine Co.:
Motor-driven Portable Hydraulic Press..Feb. 210
Northwest Chemical Co.:
Improved Drawing Compound for Stamping Operations ..... Jan. 190
Norton Co.:
Alundum Abrasives for Wet Tumbling..Feb. 205
Notching Flanged Shell, Die Equipped with Three Tool Bits for. John P. Junk.....Nov. 181
Notching Press, Edward Hallander.....Dec. 212
Nox-Rust Chemical Corporation:
Non-corrosive Rust Remover for Precision Bearings and Machined Surfaces.....Mar. 184
Nu-Braze Wonderflux No. 4—A Silver Brazing Flux ..... Apr. 200
Numatics:
Four-way Air Control Valve ..... July 220
Nu-rite, Application of—A Specially Heat-treated High-speed Steel. Arthur A. Schwartz ..... Sept. 186
Nuss, Oscar, Personal of ..... Oct. 234
Nutt, Frank E., Personal of.....Feb. 238
Nylon Valve Seats Substituted for Those of Metal ..... Mar. 185

O

Oakite Products, Inc.:
"Tri-San"—A New Material for Industrial Uses ..... Sept. 207
Oakite-Vapor Cleaning Unit ..... Jan. 199
Protective Oil Used as Drying Agent and Rust Preventive ..... July 196
Self-emulsifying Solvent Utilizes "Constant-Float" Protection ..... Aug. 198
Oberg, Erik:
The Automatic Manufacturing Plant—Mass Production Shop of the Future.....Feb. 149
O'Brien, B. C., Personal of ..... July 246
O'Brien, Eugene W., Personal of.....Aug. 236
O'Brien, John J., Obituary of.....June 248
O'Brien, Robert E., Personal of.....Nov. 233
O'Brien, W. L., Personal of .....Oct. 240
Ofield, Charles N.:
Inspection Methods Under Buick's New Program ..... Feb. 139
Ogilvie, Ira R., Personal of ..... Apr. 252
Oil Bases with Wide Application, Three Cutting- ..... Aug. 200
Oil Clarifier, Honan-Crane ..... Nov. 216
Oil Exploration from Air Made Possible by "Flying Eye" ..... July 227
Oil Used as Drying Agent and Rust Preventive, Protective ..... July 196
Oils Developed for Industrial Purposes, Synthetic ..... Feb. 183
Oils for Industrial Equipment, Hydraulic. J. C. Van Gundy ..... Aug. 158
O'Keefe, Jr., Raymond T., Personal of..Jan. 211-C
Oldberg, Sidney, Personal of ..... Jan. 211-C
Oldsmobile Three-piece Bumpers, Cold-forming, Charles O. Herb. ..... Aug. 141
Olsen Testing Machine Co., Tinius:
Huge Balancing Machine for Handling Diesel-engine Crankshafts ..... Oct. 187
Olson, Arthur J., Personal of ..... Apr. 244
O'Neil-Irwin Mfg. Co.:
Di-Acro Benders Equipped with Roller Bearings ..... Sept. 232
OPA Dictatorship of Business, Some Results of the ..... Apr. 169
OPA Pricing Policy Does Not Encourage Full Employment ..... Mar. 174
Optical Comparators, New Scribing Plate for Aug. 226
Optical Micrometer, Aireon ..... May 220
Opti-Locator and Datum Block ..... Dec. 228
Optimus Detergents Co.:
Compound for Removing Flux and Welding Scale from Metal ..... Nov. 175
Heavy-duty, Floor Cleaner Developed for Cement and Tile Floors ..... June 198
Optimus Equipment Co.:
Washing and Rinsing Unit ..... Sept. 234
Washing Machine for Small Stamped Parts Nov. 202
"Opti-Setter" for Accurate Drilling to Lay-outs July 224
Osborn Mfg. Co.:
Deburring Operation Speeded 400 Per Cent by Power Brushing ..... Mar. 171
Osborne, L. E., Personal of ..... Apr. 251
Oscap Mfg. Co.:
Half-round Diamond-impregnated Hand Hones ..... Sept. 234
O'Shea, Benjamin, Personal of ..... June 242
Ostrom, Gustaf A., Personal of ..... Mar. 236
Overload Pitman for Punch Presses, Hydraulic ..... Apr. 209
Owens-Corning Fiberglas Corporation:
Fiberglas "Milled" Fibers—A New Reinforcing Agent ..... Dec. 186
Oxford Engineering, Inc.:
Multi-diameter Turning Attachment for Lathes ..... June 210
Oxweld C-45 Heavy-duty Machine-cutting Blowpipe ..... Oct. 212
Oxweld Shape-cutting Machine ..... May 196
Oxweld-Unionmelt Machine Carriage.....Jan. 201
Oxy-acetylene Cutting Machines, Electronic Control Widens Scope of ..... Jan. 189
Oxy-acetylene Shape-cutting Machine .....May 196
Oxy-acetylene Welding, see Welding
Oxygen Lancing Facilitates Scrapping of Huge Castings ..... Nov. 156

P

"Package" Power Plants, Self-contained....July 224
Packaged Hydraulic Power Assemblies, Denison Feb. 202
Packaged Line of Roller Conveyors.....Aug. 222
Packing Liner Fabric Permits "Breathing," Synthetic Waterproof ..... Mar. 184
Page, R. C., Personal of ..... Oct. 234
Paint is Again Available, Chlorinated Rubber Base ..... Mar. 185
Paisley Products, Inc.:
"Dipwrap" Compound Provides Durable Protection for Metal Products ..... Jan. 191
Pallets Save Handling Weight and Expense, Aluminum ..... July 156
Pantograph Mechanisms Used in Machining Contours and Profiles ..... Nov. 171
Papworth, W. A.:
Belt Grinding—One of the Later Developments in the Grinding Field ..... Dec. 155
Parallels for Holding Work on Magnetic Table of Grinding Machine, Milled. Frank Horack June 197
Paratex Chlorinated Rubber Base Paint is Again Available ..... Mar. 185
Park Chemical Co.:
Liquid Carburizing Process Simplifies Salt Removal ..... Apr. 201
Parker Appliance Co.:
Thread and Gasket Sealing Compound for General-purpose Use ..... Mar. 185
Parkerizing Increases Corrosion Resistance of Iron and Steel, Color ..... July 197
Parker-Kalon Corporation:
Ground-thread Set-screws and Size-marked Cap-screws ..... Mar. 218
Parker, Leo T.:
Return of Unsatisfactory Equipment....Oct. 194
When is a Purchasing Agent Personally Liable for Contracts He has Signed?..Dec. 195
Validity of Exaggerated Sales Statements June 192
Service Guarantees for Equipment.....Aug. 194
Parker Rust Proof Co.:
Color Parkerizing Increases Corrosion Resistance of Iron and Steel ..... July 197
Parks, Charles H.:
Induction Hardening Speeds up Lead-screw Production ..... July 179
Parks, John M., Personal of ..... Dec. 246
Parks, Robert A., Personal of ..... Apr. 252
Parlec Tool Co.:
Combination Grinder, Sander, and Circular Saw ..... Apr. 214
Patent Council, National ..... Dec. 167
Patent Infringements by U. S. Government, Protecting Rights of Inventors from. B. E. Shlesinger ..... Sept. 167
Patents Available for Licensing or Sale..Sept. 178
Paton, Clyde R., Personal of ..... Nov. 226
Patternmaking, see also Molding
Patterns or Templets by Electronic Control, Reproducin from ..... Jan. 175
Patterson, William B., Obituary of ..... July 250
Patton, Jr., P. J., Personal of ..... Apr. 244
Payne, Arthur Charles, Obituary of.....Dec. 250
Pearlman, George, Personal of ..... June 247
Pease Co., C. F.:
Printing and Developing Machine.....Apr. 215
Peck, C. E.:
Bright-hardening of Tools and Machine Parts in Controlled Atmospheres.....Feb. 158
Furnace Equipment for Bright-hardening Mar. 178
Peck, Russell L., Personal of ..... Mar. 230
Peerless Tool & Engineering Co.:
Lawrenz "Thread Faster" Attachment for Lathes ..... June 230
Peirce, Charles H., Personal of.....Nov. 226
Pendray, G. Edward, Personal of Sept. 244, Oct. 238
Penn Tool & Machine Co.:
Berkeley Seam-welders ..... Jan. 209-A
"Pennsalt RI-50"—A Rust-preventing Compound for Short-period Protection.....Aug. 199
Pennsylvania Salt Mfg. Co.:
Rust-preventing Compound for Short-period Protection ..... Aug. 199
Perforating of Sheet Metal, High-speed....Apr. 186
Pestrak, Walter, Personal of ..... May 239
Peters, Joseph N., Personal of ..... Aug. 247
Pharr, Jr., Jones Y., Personal of.....May 232
Phillips Chemical Co.:
Emulsion Type Cleaner for Use in Power Spray Washers ..... Mar. 184
Phosphate for Long Life, Automobile Body Parts Coated with ..... June 185
Photo-electric Tube, see also Electric Eye
Physicists Research Co.:
Profilometer Tracer ..... Dec. 224
Pick-up Unit, Precision Pressure and Deflection ..... Mar. 211
Pickering, Charles B., Personal of.....Dec. 244
Pictures, see Motion Pictures
Pierce, W. B., Personal of ..... Jan. 212-B
Piercing, "Impact Air Hammer" Units for Riveting and ..... Apr. 216
Pines Engineering Co., Inc.:
Automatic Cut-off Attachment for Pines Benders ..... Mar. 206
Pins Reduce Maintenance of Knurling Tools, Carboloy ..... May 167
Pipe and Metal Shapes, Cold-bending of. E. J. DeWitt and Harry S. Nachman..Apr. 141
Pipe Corrosion-resistant, Internal Plating Process Makes Steel ..... Jan. 191
Pipe Seals, Plastic ..... Sept. 161
Piston-forging Operation Has High Flash Point, Lubricant in ..... Feb. 174
Piston-ring Checking Machine, Sheffield Automatic ..... Nov. 206
Pistons on Mechanical Presses, Forging Aluminum Aircraft. Charles O. Herb..Nov. 149
Pitch Diameters of Precision Screw Threads, Checking. Earle Buckingham ..... Sept. 162
Pivot Bearings, Improved Methods for Lapping Radius-formed ..... Nov. 168
Plan-O-Mill Corporation:
Thread Milling Machine ..... Oct. 208
Plant Lay-outs, Three-dimensional ..... Sept. 194
Plant—Mass Production Shop of the Future, The Automatic Manufacturing. Erik Oberg Feb. 149
Plastic Adhesive for Laminated Construction, Synthetic ..... Dec. 197
Plastic Coating for Protecting Metal Products Aug. 199
Plastic Compound Used for Sealing Caps and Sleeves, G-E ..... Feb. 194
Plastic Developed by Goodrich, Non-flammable Thermosetting ..... Dec. 196
Plastic Dye Sets to Permanent Ebony Shade, Black ..... Mar. 185
Plastic Glazings Tested for Automobile Windows ..... Apr. 201
Plastic Molding Machines, Reed-Prentice..Jan. 196
Plastic Preforms, G-E Dielectric Heater for July 205
Plastic Resin Tested for Tooling Jigs, Reinforced ..... July 196
Plastic Resins Provide High-strength Materials, New .....Sept. 207
Plastic Shows Improved Qualities in Heat Test, New General Electric ..... June 198
Plastic Skin, Repair Parts Effectively Protected by ..... Nov. 174
Plastic Specimens, Testing-machine Grip Designed to Hold ..... Oct. 209
Plastic Substitute for Tung Oil in Sealing Magnesium Castings ..... Nov. 174
Plastic that is Flexible at Low Temperatures, Recently Developed ..... Feb. 195
Plastic Tubing Has Improved Flexibility, Heat-resisting ..... Mar. 185
Plastic Ways for Machine Tables, Gray....May 208
Plastic with Greatly Improved Qualities, Polystyrene ..... Sept. 206
Plastic with Unusual Resistance to Acids and High Temperatures ..... Aug. 199
Plastics and Metal Testing Equipment....Nov. 202
Plastics Guide ..... Mar. 240
Plastics Industries, Molding Presses for the. F. Chartrand ..... Sept. 172
Plastics, Information on ..... Feb. 232
Plastics Injection Press, Van Dorn.....June 224
Plastics Molding, New Motion Picture on..Aug. 185
Plastics, Vinylite—New Applications of a Product of the Bakelite Corporation....Dec. 185
Plating Process Makes Steel Pipe Corrosion-resistant, Internal ..... Jan. 191
Plating-rack Protection, Thermoplastic Air-drying Coating for ..... Aug. 198
Plug and Thread Gage Sets, Reversible....Apr. 232
Pneumatic Drills, see Drills
Pneumatics, Inc.:
Handle-grip Air Control Valve.....Mar. 220
Points, Mounted Formed Abrasive ..... Dec. 199
Polishing Aircraft-engine Crankshaft Pins at Cadillac Plant ..... Dec. 164
Polishing, Demonstration Rooms for Grinding and ..... Mar. 240
Polishing Stainless Steels Electrolytically, Process for ..... Apr. 201
Polishing Wheels, see Wheel
Polk, Louis, Personal of ..... June 247
Poly Choke Co.:
Battery of Thirty-two Automatics with Chip and Product Conveyor ..... Oct. 171
Pommer, C. G., Personal of ..... Mar. 235
Pond Engineering Co.:
Automatically Controlled Turntable Tapping Fixture ..... Aug. 205
Pond, Wallace L., Personal of ..... Dec. 242
Pope Machinery Corporation:
Twenty-fifth Anniversary Celebrated.....Dec. 177
"Porciflex" Fast Drying Enamel ..... Mar. 185
Portable Lathe, Barrett ..... Oct. 218
Porter-Cable Machine Co.:
Belt Grinding—One of the Later Developments in the Grinding Field.....Dec. 155
Porter, John Armour, Personal of.....Mar. 230
Porterfield Mfg. Co.:
"Milrad" Machine Vise ..... May 210
Porterfield, R. H., Personal of.....May 234
Positioner for Supporting Vise, Portable..Jan. 196
Positioning Control Speeds Welding, Automatic Nov. 176
Potter, Adrian L., Personal of ..... Jan. 211-C
Potter & Johnston Machine Co.:
Automatics Improved by Continuous Development Program ..... June 199
Potter Instrument Co.:
Counter Chronograph Provides Fast Method of Timing in Ballistic Tests.....July 227
Potts Co., Horace T.:
New "Elastuf" Chrome-vanadium Steel with High Strength and Toughness.....Jan. 190
Powder and Powdered Metal for Setting Diamonds, Diamond Lapping ..... Jan. 201
"Powder Metal Mix" for Setting Diamonds Jan. 201
Powder Metallurgy, Stainless-steel Parts Manufactured by ..... July 196
Power Exhibit, Westinghouse Productive..July 182
Power Plants, Self-contained "Package"...July 224
Power Units, John S. Barnes Fluid.....June 220
Pratt & Whitney Aircraft Division of United Aircraft Corporation:
Application of Cemented Carbides in Hardness Testing ..... Jan. 168
Pratt & Whitney Division Niles-Bement-Pond Co.:
Universal Gear Grinding Machine for Spur or Helical Gears ..... Oct. 204
Jig Boring Machine Equipped with Large Built-in Rotary Table ..... Oct. 216
Automatic Centering Machine ..... Nov. 196
Electrolimit External Comparator ..... Dec. 224
Electrolimit Comparator with Ball-sorting Attachment ..... Feb. 218
Electrolimit Ball Gaging Comparator....Mar. 207
Improved Air-O-Limit Comparators.....Mar. 214
Electrolimit Continuous Gaging Equipment Apr. 225
Precise Products Co.:
Vari-speed Bench Lathe ..... Mar. 196
Precision Casting on a Mass Production Basis, C. O. Herb ..... May 149
Precision Diamond Tool Co.:
"Castweld" Set Industrial Diamonds..Sept. 240
Diamond Cup-shaped Honing Wheel....Jan. 208
Honing Wheel Facilitates Finish-sharpening of Carbide Tools ..... June 176
Precision on a Mass Production Basis, Toolroom. Charles O. Herb ..... Oct. 139
Precision to Extremes, It is Possible to Carry Oct. 184
Precision Welder & Machine Co.:
Foot-operated Spot-welder ..... Nov. 206
Precisionaire Instruments, "Airsnap" Fixtures for Use with ..... May 204

"Pre-Selectric" Power Feeder for Deep-hole Drilling, Knapp ..... Oct. 209
Press Built for Automotive Industry, Giant Bliss-Toledo Rail ..... Dec. 200
Press, Dake Electric-hydraulic ..... May 220
Press, Denison Shuttle Feed for Hydraulic ..... May 200
Press Developed for Production of Heavy Precision Forgings, Giant ..... Sept. 218
Press, Double-acting Attachment Permits Deep Drawing on a Single-acting. Fred B. Money ..... Aug. 195
Press Equipped for Sizing and Finishing Bores of Shock Absorbers, Colonial ..... Feb. 213
Press, Flexible-power Mechanical ..... Feb. 201
Press, Gleason Quenching ..... Mar. 198
Press Guard, Dake Punch ..... May 218
Press, Lake Erie Bending and Forming....Mar. 206
Press, Mead Pneumatic Column ..... May 198
Press, Mech-Art Hydraulic ..... Dec. 220
Press, Northern Hydraulic ..... Feb. 210
Press, Punch, see Punch
Press, Rodgers Sixty-ton Shop ..... June 222
Press, Thomas Inclinable ..... Mar. 189
Press, Van Dorn Plastics Injection.....June 224
Press, Wilson Light-weight Blanking and Forming ..... Aug. 207
Press with Continuous Dial Feed and Automatic Work Ejector, Hy-Mac ..... Dec. 201
Press with Total Height of 43 Feet, Giant Good-son Hydraulic ..... Sept. 188
Press Work, Selecting Drawing Compounds for. James McElgin ..... Apr. 157
Presses Developed for Assembling Steel Sleeves in Cylinder Blocks, Colonial ..... Dec. 213
Presses for the Plastics Industries, Molding. F. Chartrand ..... Sept. 172
Presses, Forging with Closed Dies in Hydraulic. C. W. Hinman ..... Feb. 176
Presses, Munton Hydraulic ..... Dec. 222
Presses, Sargeant "Counting-Guard" for Power ..... Jan. 205-B
Presses, Warco All-steel Welded ..... May 200
Presses, Watson-Stillman General-purpose and Heavy Forming ..... Aug. 214
Presses, Wroble Hydraulic ..... July 207
Pressure and Deflection Pick-up Unit, Precision ..... Mar. 211
Pressure Chart, Tubing ..... Sept. 185
Pressure, Instrument for Accurately Measuring Gas or Liquid ..... Oct. 187
Pressure Relieving Devices, Grinder with Hydraulic ..... Feb. 187
Price, Gwilym A., Personal of ..... Mar. 236
Price, R. W., Personal of ..... Aug. 236
Prices of Used Machinery, Determining the Base ..... May 179
Prindiville, John J., Obituary of..... June 248
Printing and Developing Machine, Pease..Apr. 215
Prisoner-of-War Writes to MACHINERY, An Ex- ..... Apr. 199
Prize Winners in Ingenious Mechanism Contest ..... July 192
Prizes for Articles on Ingenious Mechanisms, Five Hundred Dollars in.....Feb. 157, Apr. 156
Prizes for Papers on Resistance Welding..Feb. 246
Proctor Electric Co.:
Hydraulic Strippers Facilitate Drawing of Thin Shells ..... Dec. 147
Production is the Main Foundation of Maximum Employment ..... Dec. 189
Production is the Solution to Economic Problems, Increased ..... July 178
Production, The Human Factor in Mass..Feb. 182
"Pronucto-Chek" Gage Kit, DoAll ..... Feb. 204
Profile Grinding Machine ..... Aug. 204
Profile Projector and Universal Measuring Apparatus, "Sip" ..... June 201
Profiling Machine, Springfield Hydraulic..Apr. 206
Profilometer Tracer ..... Dec. 224
Progressive Welder Co.:
"Ultra-Speed" Welder Control Unit....Mar. 197
Resistance Welding with Storage-battery Power ..... Aug. 167
Projector and Universal Measuring Apparatus, "Sip" Profile ..... June 201
Projector, "SIP" Profile ..... Dec. 212
Propeller-shaft Bearings, Rapid Milling of ..... Aug. 180
Protective Coatings Corporation:
Synthetic Waterproof Packing Liner Fabric Permits "Breathing" ..... Mar. 184
"Protecto-Coat" for Protecting Tools During Shipment and Storage ..... Aug. 171
Protractor, Universal Lay-out ..... Mar. 220
Pruitt, Harris, Personal of ..... Feb. 240
"PSC" Emulsion Type Cleaner for Use in Power Spray Washers ..... Mar. 184
Public Relations Job, A Good Navy.....July 187
Pull-head for Off-center Broaching, Adjustable ..... Mar. 218
Pump, Barnes Equalized "Roto-Blade"....July 214
Pump Body Cavities, Jigs and Fixtures Designed for Milling Gear- ..... Apr. 196
Pump, Gray-Mills Bronze Gear ..... June 212
Pump, High-pressure Superdraulic ..... Apr. 228
Pump Manufacture, Tool-room Precision on a Mass Production Basis in. Charles O. Herb ..... Oct. 139
Pump, McIntyre Pressure Lubrication.....June 203
Pump, McIntyre Pressure Lubrication.....Nov. 200
Pump, Worthington Variable-stroke ..... May 201
Pumps for Hydraulic Systems, Seco Fluid Power ..... Dec. 204
Pumps, McIntyre Light-weight Rotary..Jan. 208-B
Punch, Center, see Center
Punch Presses, Diamond Power.....May 206
Punch Presses, Hydraulic Overload Pitman for ..... Apr. 209
Punch Presses, New Line of ..... Nov. 210
Punching Holes in Short Tubes, Die for..Jan. 188
Punching Units, Wales-Strippit Hole-.....Feb. 226
Purchaser of the Product, The Real Employer is the ..... Oct. 184
Purchasing Agent Personally Liable for Contracts He has Signed? When is a. Leo T. Parker ..... Dec. 196

Q

"Q-Two" Fastener, Shakeproof ..... June 202
"Quadrill" Equipped with Indexing Device ..... Dec. 228
Quaker Chemical Products Corporation:
Water-soluble "Microgrind" Fluid ..... May 218
Quality Control by Statistical Methods, Course in ..... Oct. 161
Quality Control, Course in ..... Feb. 246
Quenching Press, Gleason ..... Mar. 198
Quincy Compressor Co.:
Film on Industrial Air Power.....June 168
Quisenberry, J. L., Personal of.....Dec. 239

R

Rack Flame-cut to Shape, Teeth of.....Oct. 230
Racks, Portable Automatic Material-handling ..... June 217
Radii Attachments for Lay-out, Scribing, and Measuring Work ..... Sept. 230
Radio Manufacture, Office of Price Administration Said to Retard ..... Sept. 175
Radio Telephone System Provides Service for Moving Vehicles, Mobile ..... Apr. 191
Radius Grinding Attachment, Cincinnati..Apr. 207
Railroad—A Stepchild of Government, The ..... Sept. 240
Ramsey, Hobart C., Personal of.....Sept. 244
Randall, B. H., Personal of ..... Apr. 244
Ransome Machinery Co.:
Self-propelled Turning Rolls Facilitate Automatic Welding of Tanks ..... June 167
Read, Fred M., Personal of.....Nov. 226
Reamers, Daniels Precision ..... July 216
Reamers, Rogers ..... Aug. 222
Reamers with Flute-long Carbide Tips, Solid ..... Feb. 205
Reaming, Boring, and Tapping Machine, LeMaire Special Wheel-cylinder Drilling, ... Mar. 204
Reaming Rocket-shell Plates, Baker Multiple-spindle Machines for Drilling and.....Sept. 211
Reaming, Speeds, Feeds, and Lubricants for ..... Aug. 157
Reaming Unit, Hesco Drilling and.....Feb. 220
Reciprocating Slide Mechanism for Feeding Parts from a Stack.....Feb. 190
Reconditioner, Improved Tap ..... Sept. 228
Reconversion, Tool Engineers Have Greatly Speeded Up ..... May 180
Reconversion Will Help Prevent Inflation, Speedy ..... Sept. 240
Recorder, G-E Automatic Humidity.....Aug. 220
Red Ring Internal Gear-shaving Machine..Oct. 214
Redesign of Blanked Part Simplifies Production ..... May 185
"Redi-Heat Block" for First-aid Use.....July 175
Redmer Air Devices Corporation:
Foot Control and Valve for Air-operated Equipment ..... Dec. 226
Air-operated Collet Chuck ..... Mar. 193
Redpath, W. A., Personal of..... Oct. 234
Reducer, Speed, see Speed
Reed Engineering Co.:
Plate-bending Rolls ..... Feb. 199
Reed, Franklin A., Personal of ..... Sept. 244
Reed-Prentice Corporation:
Plastic Injection Molding Machines.....Jan. 196
Reed Thread-rolling Machine ..... June 204
Reel, Heavy-duty Constant-speed, Constant-tension Winding ..... Oct. 218
Refrigerator or Condenser Coils, Automatic Arrangement for Silver-soldering.....June 178
Refrigerators and Boilers Operated by Sun Power ..... Aug. 187
Reich Mfg. Co., J. R.:
Center-lapping Tool ..... May 222
Reichl, Dr. R. M., Personal of ..... July 240
Reiser, Jr., Fred, Personal of.....Feb. 238
Relay, Allen-Bradley Universal Solenoid..Aug. 204
Release Fluid and Compound Aid Rubber and Plastic Molding, Silicone Mold ..... Mar. 184
Reliance Electric & Engineering Co.:
Automatic Positioning Control Speeds Welding ..... Nov. 176
Largest Pressure-cast Rotor Ever Made for Electric Motors ..... Dec. 186
Republic Drill & Tool Co.:
"Jet" Drill for High-speed Production Drilling ..... Mar. 218
Research and Engineering Center Planned, Ford ..... July 168
Research Foundation Organized by Stevens Institute ..... Jan. 192
Research Should be Made Public.....Dec. 188
Resins Developed for Impression Molding, Thermosetting ..... Sept. 206
Resistance Welder Manufacturers' Association: New Officers Elected ..... Apr. 198
Resistance Welding, see Welding
Resistoflex Corporation:
Synthetic Material Superior to Natural Rubber ..... Nov. 175
Resonance Tube, Troubles in Steam Turbines or Other Rotating Equipment Detected by ..... Aug. 171
Retract-A-Tool for Thread Cutting, Foulk..May 222
Return Unsatisfactory Equipment, Buyer's Right to. Leo T. Parker ..... Oct. 194
Revere Copper & Brass, Inc.:
New Free-cutting Copper Rod Saves Machining Time ..... Dec. 196
"Reverso" Thread Plug Gage ..... May 220
Rex Machine Tool Flexible Conduit.....Aug. 222
"Reynalite"—New Building Material Consisting of Aluminum Bonded to Cellulose Core ..... July 163
Reynolds, C. H., Personal of ..... Sept. 246
Reynolds Metals Co.:
Aluminum Pallets Save Handling Weight and Expense ..... July 156
Aluminum Bonded to Cellulose Core Forms New Building Material .....July 163
Aluminum Alloy Combines Strength and Free Machining Properties ..... Aug. 200
R-F-L Air Regulating, Filtering, and Lubricating Unit ..... Jan. 204
Rhoades, Jr., C. M., Personal of.....June 242
Rings for Ball Bearings, Waldes "Truare" Retaining ..... Oct. 222
Ritter, Harold J., Personal of ..... Jan. 212
Rivet for Peacetime Mass Production, Improved Explosive ..... Dec. 186
Rivet in Sheet-metal Plate, Die for Forming Extruded, Wallace C. Mills ..... Dec. 191
Rivets and Pneumatic-hydraulic Rivet Gun, Cherry ..... Jan. 209-A
Rivets, "Umbrella Plug" for Covering Heads of Hollow Cherry ..... Feb. 226
Riveting and Piercing, "Impact Air Hammer" Units for ..... Apr. 216
Riveting Fixture for Grooved Stud ..... Jan. 186
Riveting Hammer, Pneumatic ..... Mar. 199
Robbins, John T., Personal of ..... Jan. 212
Robinson Aviation, Inc.:
"Vibrashock" Mounting for Delicate Equipment ..... Feb. 224
Robinson, Glen A.:
Copper Furnace Brazing ..... Dec. 139
Robinson, William C., Personal of ..... Oct. 240
Robot Mechanism Used to Automatically Load and Unload Equipment for Machining Shells. Erik Oberg ..... Feb. 149
"Robot Rembrandt"—A New Device Facilitating Drafting-room Work ..... Aug. 186
Rocket Ascends 43½ Miles at Velocities Faster than Sound ..... July 175
Rocket-shell Plates, Baker Multiple-spindle Machines for Drilling and Reaming....Sept. 211
Rockwell, Colonel W. F., Personal of.....July 246
Rockwell Co., W. S.:
Automatic Pusher Type Normalizing Furnace ..... Mar. 197
Rodgers Hydraulic Inc.:
Sixty-ton Shop Press ..... June 222
Rods, Flux-coated Bronze Welding ..... May 224
Roemer, Jr., H. A., Personal of ..... July 240
Rogers Corporation:
Improved Electrical Insulating Board Made of Non-cotton Cellulose ..... Nov. 175
Rogers Machine Works, Inc.:
Vertical Turret Mill Equipped for Special Boring Operation ..... Apr. 222
Rogers Mfg. Co., Dayton:
Heavy-duty Pneumatic Die Cushions....Oct. 216
Hydraulic Overload Pitman for Punch Presses ..... Apr. 209
Rogers Tool Corporation, John M.:
Type S Reamers ..... Aug. 222
Roll, Webb Initial Pinch Type Bending....Nov. 220
Rolls, Reed Plate-bending ..... Feb. 199
Rolled Thread Die Co.:
Reed Thread-rolling Machine ..... June 204
Roller Bearing, Bantam Self-aligning Spherical ..... Mar. 214
Roller Bearing Sizes, Standardization of Ball and ..... Apr. 159
Roller Thrust Bearing Carries Heavy Loads at High Speeds, New Spherical ..... June 184
Roller Thrust Bearings, Kaydon Conical..Mar. 211
Rollers, Hardened Steel ..... Oct. 194
Rolling Dies, Jones & Lamson Automatic Self-opening Die-heads and Ground-thread Flat ..... June 208
Rolling Machine, Reed Thread- ..... June 204
Rolling Process, Recent Applications of the Thread- ..... Dec. 161
Rolling, Production of Clad Steels by. Charles E. Wick ..... July 158
Root Co., B. M.:
Hydraulic-feed Multiple Drilling and Boring Machine ..... Sept. 220
Root, Ralph R., Personal of ..... Sept. 246
Rose, Floyd, Personal of.....Nov. 233, Jan. 212-B
Rose, Robert S., Personal of ..... Oct. 236
Ross Operating Valve Co.:
Solenoid-controlled Air Valve ..... July 218
Rotakit Assortment of Files and Burrs....Dec. 222
Rotating Motion with Quick Take-up Action, Interrupted. L. Kasper ..... Feb. 189
Rote, Franklin B.:
The Forging of Magnesium ..... June 141
Rothenberger, L. R., Personal of ..... Apr. 254
"Roto-Blade" Pump, Barnes Equalized.....July 214
"Rotocast" Hydraulic Cylinders, Logan....Dec. 224
"Roto-Checker" for Crankshafts, Anderson ..... Oct. 222
Roto-Finish Machine for Mechanical Finishing of Small Parts ..... Mar. 202
Roto-Matic Milling Machine, Davis & Thompson ..... Jan. 198
Rougraff, Emil, Personal of ..... June 247
Royal Oak Tool & Machine Co.:
Tool Grinding Machine ..... Aug. 208
Royal Products:
Empire Live Centers with Interchangeable Points ..... Apr. 224
Rubber Base Paint is Again Available, Chlorinated ..... Mar. 185
Rubber Becomes Commercially Available, Silicone ..... Sept. 210
Rubber-Flex Drill Chucks, Jacobs.....Nov. 218
Rubber for Forming Magnesium, Heat-resistant Synthetic ..... Jan. 181
Rubber, Synthetic Material Superior to Natural ..... Nov. 175
Rudel, William E., Personal of ..... Aug. 236
Rust Furnace Co.:
Largest of Three Stress-relieving Furnaces ..... June 184
Rust Inhibitors Developed for Inside Storage Protection ..... Dec. 197
Rust-preventing Compound for Short-period Protection ..... Aug. 199
Rust Preventive, Protective Oil Used as Drying Agent and ..... July 196
Rust Remover for Precision Bearings and Machined Surfaces, Non-corrosive ..... Mar. 184
Rustay, Arnold L.:
The Forging of Magnesium ..... June 141
Rustless Iron and Steel Division of American Rolling Mill Co.:
Process for Polishing Stainless Steels Electrolytically ..... Apr. 201
Ruthenburg, Louis:
Sound Industrial Relations for Sound Industrial Progress ..... Jan. 169
Ruthman Machinery Co.:
"Axiaflo" Circulators ..... Sept. 224
Ryley, Thomas W., Obituary of ..... June 250

S

Safety Code for Industrial Use of X-rays..July 187
Safety Color Code.....Sept. 250
Safety Device, Gemco Shaper with "Lubrigard" ..... Feb. 202
St. Vincent, Frank, Personal of ..... Dec. 248
Saiter, Charles H., Personal of ..... Sept. 249
Sales Statements, Validity of Exaggerated. Leo T. Parker ..... June 192
Salsbury Motors, Inc.:
Automatic Clutches .....Jan. 209-A
Automatic Transmission ..... July 220
Salt Removal, Liquid Carburizing Process Simplifies ..... Apr. 201
Salvaging Castings, New Method of.....Sept. 161
Samson Grinding-wheel Dresser ..... May 212
"Sand Re-nu" Cleaning Compound.....Aug. 198
Sander, Grinder, and Circular Saw, Parlec Combination ..... Apr. 214
Sander, Sand-O-Flex Contour ..... Aug. 218
Sand-O-Flex Corporation:
Contour Sander ..... Aug. 218
Sanne, E. J., Personal of ..... Jan. 211-C

Sapphire Products Division, Elgin National Watch Co.:
Elgin Plug Gages with Flexible Handles ... May 204
Elgin Sapphire-tipped Micrometer ... July 222
Saran Coating Materials Provide Moisture-vapor Protection, Two ... Aug. 200
Sasgen, A. M., Personal of ... Jan. 211-C
Sasgen, Michael J., Obituary of ... Sept. 252
Saunders, Charles L., Personal of ... May 232
Saw, Air-speed Pneumatic ... Dec. 208
Saw, Band, see Band
Saw Blade Grinder, Espen-Lucas Circular ... Nov. 218
Saw Blades, Lubricant Improves Action of Metal-cutting ... Sept. 207
Saw, DoAll High-speed Metal ... May 199
Saw-gun, Streamline ... Feb. 224
Saw, Monarch Uni-Point Radial ... Apr. 216
Saw, Wyco Hy-Speed ... Apr. 224
Sawing Machines, Motch & Merryweather Metal Cutting-off and ... May 197
Sayle, Mrs. Florence M., Personal of ... Aug. 242
Sayle, W. Chichester, Obituary of ... Nov. 234
Scale from Metal, Compound for Removing Flux and Welding ... Nov. 175
Schantz, Grover C., Personal of ... Apr. 246
Schauer Machine Co.:
Multi-purpose Speed Lathe ... Dec. 220
Scherr Co., George:
Precision Hand Tachometers ... Dec. 213
Chesterman Large-sized Height Gage ... Apr. 217
All-purpose Tool-grinding Fixture ... May 216
Schlendorf, J. M., Personal of ... Sept. 246
Schlesinger, Dr. G.:
Equipment Designed to Facilitate the Use of Diamond Tools ... June 179
Schmidt, J. J., Personal of ... June 247
Schnacke Mfg. Corporation:
Adjustable Flush-pin Gage ... Dec. 216
Schoen, E. W., Personal of ... July 240
School, see also Apprentices, Education, Training, Vocation
Schools, Surplus Machines for Demonstration Rooms in Trade ... Jan. 179
Schranz, Frederick G., Personal of ... Jan. 212
Schreiber, H. A.:
Facing Large Aluminum Castings on a Milling Machine with a Lathe Tool ... Apr. 198
Schultz, Max J., Personal of ... June 242
Schultz, Russel A., Personal of ... Oct. 236
Schuman, Frank J., Personal of ... Oct. 234
Schwartz, Arthur A.:
Application of Nusite—A Specially Heat-treated High-speed Steel ... Sept. 186
Rapid Grinding of Milling Cutters for Continuous Production ... Feb. 179
Schwartz, Donald L., Personal of ... Dec. 242
Sciaky Bros.:
Overhead Spot-welders ... Dec. 218
Scientific Management, see Management
Scott, Eugene T., Personal of ... Mar. 228
Scraper, Carboloy-tool Rotary Floor ... Feb. 186
Screw Machine Drills, Chicago-Latrobe Stub ... May 196
Screw Machine, see also Automatic
Screw Machines, High-speed Chain Drives for Automatic ... Aug. 172
Screw Machines, Spindle-control and Collet-operating Mechanism for, A. W. Jansson ... July 189
Screw Machines, Tavannes Single-spindle Automatic ... Apr. 220
Screw Thread, see Thread
Screws, Equipment for Grinding Conical Surfaces on Small Pivot ... Sept. 185
Screwdriver Bits, "Unbrako" Key Kit with Nine ... Sept. 230
Scribing Plate for Optical Comparators, New ... Aug. 226
Sealing Caps and Sleeves, G-E Plastic Compound Used for ... Feb. 194
Sealing Compound for General-purpose Use, Thread and Gasket ... Mar. 185
Sealing Magnesium Castings, Plastic Substitute for Tung Oil in ... Nov. 174
Searlcant Co., W. H.:
"Counting-Guard" for Power Presses ... Jan. 205-B
Sears, Joseph W., Personal of ... Jan. 212-D
Seco Fluid Power Pumps for Hydraulic Systems ... Dec. 204
Second-operation Machine Designed for High-speed Production, Hardinge Precision ... July 201
Sectionalized Assembly or Production Line ... May 167
Sedam, M. G., Personal of ... July 246
Seguin, George D., Personal of ... Feb. 238
Seitz, Raymond L., Personal of ... May 232
Selas Corporation of America:
Comparative Study of Electric and Gas-Air Methods of Silver Brazing ... Jan. 151
"Selch" End-mills and Holders ... Aug. 216
Seneca Falls Machine Co.:
Imp Lo-Swing Automatic Lathe with Rotary Loader and Double-end Drive ... Feb. 196
Seniority Rules Work Hardship on Able Young Men ... July 188
Sentry Co.:
Electric Heat-treating Furnace ... Feb. 226
Separator for Screw Machine Products, McKenzie Chip ... July 205
Service Guarantees for Equipment, Leo T. Parker ... Aug. 194
Servicemen, Apprntice Training for Returning ... Dec. 185
"Servotron" Electronically Controlled Variable-speed Drive ... Dec. 226
Set-screws and Size-marked Cap-screws, Parker-Kalon Ground-thread ... Mar. 218
Set-up Blocks, Moore ... June 217
Shaeffer, Paul H., Personal of ... Dec. 246
Shafer, John S., Personal of ... Apr. 244
Shaft Facing and Centering Machine ... Apr. 204
Shafts and Studs, Jig for Drilling Cross-pin Holes in ... Feb. 212
Shakeproof, Inc.:
"Q-Two" Quick-operating Fastener ... June 202
Shaper Bit-holder, Combination Contour ... May 201
Shaper with Improved Ram, Smith & Mills Crank ... Feb. 204
Shaper with "Lubrigard" Safety Device, Gemco ... Feb. 202
Shaper with Variable-speed Drive ... Mar. 210
Sharer, R. P.:
Gear Production Problems Solved by Automatic Welding ... Nov. 153
Sharpening Machine, Landis Universal Grinding and Tool ... Sept. 224
Shaving Machine, Red Ring Internal Gear- ... Oct. 214
"Shearcutter" Tool Bit ... June 224
Shears, Cleveland Power-driven Metal-cutting ... Feb. 197
Sheet Metal, High-speed Perforating of ... Apr. 186
Sheet Thickness, Gage for Inspecting Bonds of Laminated Materials or Measuring ... May 224
Sheffer, J. W., Personal of ... June 242
Sheffield Corporation:
Diamond Dressing Device for Multi-ribbed Thread Grinding Wheels ... Oct. 220
Tungsten-carbide Thread Plug Gages ... Nov. 200
Automatic Piston-ring Checking Machine ... Nov. 206
New Crush-dressing Applications ... Jan. 143
Sine-bar Fixture ... Jan. 197
Templet Grinding Machine with Electronic Control ... Mar. 192
Fish-Schurman Optical Contour Comparator ... Apr. 217
"Airsnap" Fixtures for Use with Precision-aire Instruments ... May 204
Sherman & Co.:
Silver Brazing Flux Reaches Maximum Fluidity at Low Temperature ... Apr. 200
Sherwood, Roland A., Personal of ... Mar. 235
Shifter, Automatic Back-gear, W. F. MacGlashan, Jr. ... Aug. 193
Shipment and Storage, Protecting Cutting Tools During ... Aug. 171
Shipping, Aluminum Pallets Used in ... July 156
Shlesinger, B. E.:
Protecting Rights of Inventors from Infringements by U. S. Government ... Sept. 167
Shock-absorbing Mounting for Delicate Equipment ... Feb. 224
Shrink-fitting Operations, Standard-cycle Induction Heaters Speed ... Feb. 156
Shuttle Feed for "Multipress," Denison ... May 200
Sibley Machine & Foundry Corporation:
Drilling Machine ... June 228
"Sight-Screener" for Checking Employes' Vision ... Apr. 199
"Silastic" Becomes Commercially Available ... Sept. 210
Silicone Compound Prevents Foaming of Aqueous Solutions and Emulsions ... July 197
Silicone Greases for High- and Low-temperature Bearing Lubrication ... Feb. 194
Silicone Insulation for High Temperatures ... June 173
Silicone Mold Release Fluid and Compound Aid Rubber and Plastic Molding ... Mar. 184
Silicone Rubber Becomes Commercially Available ... Sept. 210
Silmanal Permanent-magnet Material ... July 236
Silver Brazing, Comparative Study of Electric and Gas-Air Methods of, Paul F. Berg ... Jan. 151
Silver Brazing Flux Reaches Maximum Fluidity at Low Temperature ... Apr. 200
"Silver Haritem" Die Steel for Use in Zinc-alloy Die-casting ... June 198
Silver-soldering Refrigerator or Condenser Coils, Automatic Arrangement for ... June 178
Simmons Machine Tool Corporation:
Shaper Equipped with Micro-Speed Drive ... Mar. 210
Simmons, Sr., Charles A., Personal of ... Aug. 240
Simon, F. F., Personal of ... Aug. 247
Simonds Abrasive Co.:
Modern Flat Surface Grinding Practice:
1 ... May 168
2 ... June 158
3 ... July 169
Simonds Saw & Steel Co.:
New Trademark Adopted ... Mar. 238
Simplex Engineering Co.:
Seco Fluid Power Pumps for Hydraulic Systems ... Dec. 204
Simplex Tool Engineering Co.:
Special Five-unit Drilling Machine ... Sept. 228
Automatic Drilling, Etching, and Cleaning Machine ... Mar. 211
Simplified Practice for Band Saws ... Nov. 222
Simplified Practice for Bolts and Nuts ... June 192
Simplified Practice for Grinding Wheels, Proposed Revision of ... Aug. 185
Simplified Practice for Machine, Carriage, and Lag Bolts ... Dec. 177
Simpson, William C., Personal of ... Nov. 230
Sims, W. K., Personal of ... Apr. 246
Sine-bar Fixture, Sheffield ... Jan. 197
Sine Bar with Adjustable Blocks, William H. Manton ... Mar. 183
Sine Bars, Blocks, Plates, and Fixtures, Commercial Standards for ... Apr. 172
Singleton, J. L., Personal of ... Jan. 212-D
Sip High-precision Jig Borer, New ... July 202
"Sip" Profile Projector and Universal Measuring Apparatus ... June 201
Sipchen, John H., Personal of ... Feb. 234
Size Control Co., Division of American Machine & Gage Co.:
Reversible Thread Gages ... Nov. 220
Reversible Plug and Thread Gage Sets ... Apr. 232
Centerless Lapping Machine ... June 222
Sjostrom Machine Co.:
Magnetic Shop Floor Sweeper ... Nov. 178
S K F Industries, Inc.:
New Spherical Roller Thrust Bearing Carries Heavy Loads at High Speeds ... June 184
Skillin, Walter F., Personal of ... Nov. 226
Skin, Repair Parts Effectively Protected by Plastic ... Nov. 174
Slides for Holding Drill Jigs to Table ... July 195
Slotting Cutter, Lovejoy Improved ... May 197
Slotting Marine Bearings on Special Planer Type Milling Machine ... Apr. 151
Slottman, George V., Personal of ... Mar. 235
Smalley, Alvin K., Obituary of ... Apr. 254
Smith, Alvah, Personal of ... July 246
Smith, C. C., Personal of ... Aug. 236
Smith, Charles F.:
Helical Cutter with Adjustable Blades ... July 193
Smith, Clarence L., Personal of ... Feb. 234
Smith, Earle C., Personal of ... Mar. 240
Smith, George, Personal of ... Apr. 244
Smith, Harry E., Personal of ... Apr. 246
Smith, I. C., Personal of ... Mar. 235
Smith, J. J., Personal of ... Nov. 228
Smith, John C., Personal of ... Nov. 224
Smith Mfg. Co., F. H.:
Gages for Setting Form Tools and Gaging Lengths ... Apr. 230
Smith, Marshall M., Personal of ... June 238, Aug. 238
Smith & Mills Co.:
Crank Shaper with Improved Ram ... Feb. 204
Snyder, George L.:
What the Designer Should Know About Welded Machinery Parts:
1 ... Jan. 157
2 ... Feb. 167
Snyder Tool & Engineering Co.:
Seven-station Machine Designed for Machining Automotive Steering Knuckles ... June 212
Societe Genevoise d'Instruments de Physique:
"Sip" Profile Projector ... Dec. 212
"Sip" Profile Projector and Universal Measuring Apparatus ... June 201
"Sip" High-precision Jig Borer ... July 202
Society for the Advancement of Management:
Digest of Frank B. Gilbreth's Films Now Available ... Mar. 180, May 185
Society of Automotive Engineers:
Air Transport Engineering Meeting in Chicago ... Dec. 164
Annual Meeting to be Held in Detroit ... Jan. 175
Society of the Plastics Industry:
Information on Plastics ... Feb. 232
Soldering Flux that Leaves No Harmful Residues, A Soft ... Feb. 195
Soldering Refrigerator or Condenser Coils, Automatic Arrangement for ... June 178
Soldering, Unusual Results with Automatic, W. R. Graham ... Oct. 158
Solenoid, Barnes Improved Midget-size ... Aug. 211
Solenoid Relay, Allen-Bradley Universal ... Aug. 204
Soler, Gilbert, Personal of ... Sept. 246
Solvent Utilizes "Constant-Float" Protection, Self-emulsifying ... Aug. 198
Solvents for Cleaning Precision Bearings and Instrument Parts, Safety ... Mar. 185
Somers, Major Joseph P., Personal of ... June 247
Somerville, P.:
Electronic Equipment Facilitates Wire-rope Manufacture ... Jan. 171
Sommer, Eric E., Obituary of ... July 250
Sorenson, Carl P., Personal of ... Oct. 234
Sound-conditioning, Working Conditions in a Machine Shop Improved by, Francis A. Westbrook ... June 188
Sound Gaging Device for Blind Inspectors, Electronic ... July 174
South Bend Lathe Works:
Precision Bench Lathe ... Sept. 238
Spectrometer Analyzes Alloys in Forty Seconds ... Jan. 180
"Speed-Matic" Manufacturing Lathe ... Mar. 187
Speed Reducers, Janette ... Dec. 228
Speed Unit for Drill Presses, Weaver Variable- ... Aug. 210
Speeds, Feeds, and Lubricants for Reaming ... Aug. 157
Spencer, Howard, Personal of ... Nov. 228
Sperry Products, Inc.:
Miniature Hydraulic Control ... May 216
Spherical Turning, Lathe Set-up for ... July 195
Spindle and Frequency Generator, High-cycle Grinding ... June 228
Spindle-control and Collet-operating Mechanism for Screw Machines, A. W. Jansson ... July 189
Spinning by Modern Methods, Metal, Edwin Weiss ... Nov. 141
Spinning, The Technique of Metal, Edwin Weiss ... May 159
Spitfire Tools, Inc.:
Roller Lapping Machine ... Jan. 209-C
Spoerl, Walter F., Personal of ... Apr. 246
Spot-facing, Drilling, Counterboring, and Tapping, "Hy-Mac" Special Machine for ... July 204
Spot-welding, see Welding
Spring, Die for Forming Irregular-shaped, L. Kasper ... Dec. 185
Spring Hangers Tapped in Eight Seconds, Threaded ... Apr. 165
Spring Specialty Co.:
Leigh High-speed Flexible-shaft Grinder ... June 230
Springs, Utilizing Residual Forming Stresses in Flat Steel, W. C. Troy ... June 152
Springer, B. A., Personal of ... Feb. 234
Springfield Machine Tool Co.:
Hydraulic Profiling Machine ... Apr. 206
Stacey, E. L., Personal of ... Sept. 250, Nov. 224
Stack-cutting Provides Fabricating Short-cuts ... Nov. 160
Stainless Heat-treatable Steel Now Available for General Use ... Feb. 194
Stainless-steel Electrodes, Lincoln Improved ... Apr. 205
Stainless-steel Hose, Flexible ... Oct. 170
Stainless Steel Made Possible by New Equipment, Torch-cutting of ... Sept. 190
Stainless-steel Parts Manufactured by Powder Metallurgy ... July 196
Stainless Steel, Passivating Process Permanently Blackens ... July 196
Stainless-steel Tubing Data Chart ... Apr. 199
Stainless-steel Valves, Machining, A. P. Nelson ... July 148
Stainless Steels Electrolytically, Process for Polishing ... Apr. 200
Stainless Steels, Nitriding ... Aug. 234
Stainless Surface Hardening Co.:
Passivating Process Permanently Blackens Stainless Steel ... July 196
Stainproof Finish, New Synthetic Enamels Provide Hard ... Feb. 194
Stamets, Jr., Lieutenant William K., Personal of ... Aug. 247
Stamm, George W., Personal of ... May 239
Standard Based on Work, High Living ... Oct. 232
Standard Gage Co., Inc.:
"Decimatic" Indicators for Checking Close Tolerances ... May 212
Small Dial Type Bore Gage ... May 218
Dial Comparator ... June 212
Standard Grays for Engineering Equipment ... June 192
Standard Pressed Steel Co.:
"Unbrako" Key Kit with Nine Screwdriver Bits ... Sept. 230
Standards Catalogue Available, American ... Aug. 149
Standards for Sine Bars, Blocks, Plates, and Fixtures, Commercial ... Apr. 172
Standards, Metric Screw Thread ... Dec. 238
Standards, Pocket-size Set of Surface Finish ... Dec. 218
Standardization of Ball and Roller Bearing Sizes ... Apr. 159
Standardization of Electrical Equipment for Machine Tools, R. H. Clark ... Jan. 176
Standardized, Life Tests of Single-point Cutting Tools Now ... Aug. 175
Star Friction-drive Tapping Machine ... Jan. 204-B
"Star" Live Centers ... Feb. 220

Starbird Pressure-operated Switches.....Feb. 212
Starrett, Arthur H., Personal of.....Mar. 230
Starter Developed for Aviation Gas Turbines, Electric ..... Apr. 191
Staybolt Taps, Grinder for Sharpening....Dec. 210
Steam Cleaning Unit, Portable ..... June 177
Steam Platens Produced by Welding.....Sept. 178
Stedfast, Albert R., Obituary of.....Aug. 248
Steel Castings for Use at Extremely Low Temperatures, High Impact Values of..June 190
Steel Castings, New Type of Thermit for Producing ..... Jan. 191
Steel City Testing Laboratory:
Hardness Testing Hammer for Portable Use ..... Sept. 188
Brinell Testing Machine ..... Feb. 208
Sheet-metal Ductility Testing Machine..July 204
Steel, Color Parkerizing Increases Corrosion Resistance of Iron and ..... July 197
Steel, Disintegrators for Removing Broken Taps and Cutting Hardened.....Sept. 232
Steel for Knives and Blades, A New Composite ..... Nov. 174
Steel for Use in Zinc-alloy Die-casting, Prehardened Die ..... June 198
Steel in the War ..... Apr. 199
Steel Rollers, Hardened ..... Oct. 194
Steel, see Sheet, Stainless, High-speed, Molybdenum, Nickel, NE, etc.
Steel, Some Applications of Sub-zero Treatment to. Stewart M. DePoy.....Sept. 165
Steel that Hardens in Heavy Sections, A Non-deforming Die ..... Apr. 200
Steel with Greatly Improved Machinability, New Tool ..... Nov. 174
Steel Wool Manufacture, Equipment for..May 165
Steels, Arc Welding of Alloy.....Aug. 173
Steels by Rolling, Production of Clad. Charles H. Wick ..... July 158
Steels, Improved Electrode for High-tensile ..... Oct. 206
Steering Knuckles, Snyder Seven-station Machine Designed for Machining Automotive ..... June 212
Steffy, Lott, Personal of.....Feb. 245
Steinkraus, Herman W., Personal of.....June 240
Stenger, William H., Personal of.....Mar. 236
Sterling Co., Douglas T.:
Incentive Wage Plans ..... Sept. 204
Stevens-Arnold Co.:
Precision Pressure and Deflection Pick-up Unit ..... Mar. 211
Stevens, Charles R., Personal of.....Sept. 249
Stevens Institute of Technology:
Research Foundation Organized ..... Jan. 192
Stevenson, Jr., Dr. Alexander R., Personal of ..... Apr. 246
Stevenson, Lieutenant Colonel H. A., Personal of ..... Oct. 236
Stillman, F. H., Personal of.....Apr. 246
Stix, Henry A., Personal of.....May 239
Stokes Machine Co., F. J.:
New Plastics Molding Film ..... Aug. 185
Stone, Guy M., Personal of.....July 246
Stoner, Seth H., Personal of.....Mar. 235
Stoody Co.:
Hard-facing Alloys for Electric Arc Application ..... Dec. 197
Extrusion-coated Self-hardening Electrodes ..... Aug. 203
Storage-battery Power, Resistance Welding with ..... Aug. 167
Stover, R. S., Personal of ..... June 247
Straightening Press, Anderson ..... Sept. 222
Straightening Press, Mech-Art Hydraulic..Dec. 220
Strain-gage Amplifier, General Electric....June 230
"Strainco" Portable Central Coolant System ..... Jan. 175
Strainer Products Corporation:
Portable Central Coolant System.....Jan. 175
Strasser, C. H., Personal of.....July 246
Strauss, Jr., Harry L.:
Using Diamonds for the Crush-forming of Grinding Wheels ..... Jan. 179
Stresses, Eccentric Milling Cutter Designed to Lessen Cutting ..... Sept. 204
Stresses in Flat Steel Springs, Utilizing Residual Forming. W. C. Troy.....June 152
"Strike-easy" Arc-welding Compound....Jan. 208-B
Strike, There Are Limitations Even to the Right to ..... Nov. 170
Strikes, A National Labor Policy to Minimize Industrial ..... Apr. 169
Strikes Against National Welfare are, in Effect, Civil War ..... June 194
Strikes Hold up Automobile Production, Hundreds of Small ..... July 165
Stripper Removes Organic Coatings, Enthone Enamel ..... Apr. 201
Stroboscope, Portable ..... July 207
Strohm, J. R., Personal of.....Mar. 228
Structural Material Developed in Aircraft Field, New Featherweight ..... Apr. 200
Struthers-Wells Corporation:
Self-propelled Turning Rolls Facilitate Automatic Welding of Tanks ..... June 167
Stryker, Clinton E., Personal of.....Apr. 244
Stuart Oil Co., Ltd., D. A.:
The Problem of Cutting Fluids.....Dec. 194
Stubbs, R. B.:
Aircraft Manufacturing Technique Applied to Bus Building ..... Dec. 168
Stud-drivers, Titan ..... Nov. 220
Studebaker Corporation:
Production of Starter Ring Gears Revolutionized by Electronic Process .....Jan. 192
"Robot Rembrandt"—A New Device Facilitating Drafting-room Work .....Aug. 186
Studer Ltd., Fritz:
Profile Grinding Machine ..... Aug. 204
Stuebe, Colonel Louis F. W., Personal of..Dec. 244
Stueve, R. W., Personal of ..... June 242
Sturgis Products Co.:
Roto-Finish Machine for Mechanical Finishing of Small Parts ..... Mar. 202
New Mechanical Finishing Process.....Aug. 194
Styraloy—A Plastic that is Flexible at Low Temperatures ..... Feb. 195
Styron 411—A Polystyrene Plastic with Greatly Improved Qualities ..... Sept. 206
Submarine Signal Co.:
"Servotron" Electronically Controlled Variable-speed Drive ..... Dec. 226
Sub-zero Treatment to Steel, Some Applications of. Stewart M. DePoy.....Sept. 165
Suhl, Rudolph Louis, Obituary of.....July 250
Sump Cleaners and Coolant Filters, Honan-Crane ..... Feb. 216
Sun Power, Boilers and Refrigerators Operated by ..... Aug. 187
Sunnen Products Co.:
Diamond Dressing Tool ..... Aug. 218
"Super Service" Upright Drilling Machine, Cincinnati Bickford ..... Apr. 211
Super Tool Co.:
Solid Reamers with Flute-long Carbide Tips ..... Feb. 205
Face Milling Cutter with Solid Carboloy Blades ..... May 195
Super-Treat, Inc.:
"Flash Freeze" Unit for Industrial Cold-treatment ..... Apr. 217
Superdraulic Corporation:
High-pressure Pump ..... Apr. 228
Small-size, High-power Hydraulic Motor ..... Aug. 211
Superdraulic Pump, High-pressure ..... Apr. 228
"Superdraw"—An Improved Compound for Stamping Operations ..... Jan. 190
Superior Flux Co.:
A Soft Soldering Flux that Leaves No Harmful Residues ..... Feb. 195
Superior Machine & Tool Works:
Precision Internal Grinding Machine....May 198
Superior Mfg. Co.:
Small Pneumatic Hammer ..... Oct. 226
Supervisors in Human Relations, Training..June 173
Surface Combustion Corporation:
Dual-purpose Furnace ..... Dec. 210
NX Gas Atmosphere for Heat-treating Operations ..... Jan. 180
Lift-cover, Car-bottom Furnace Used for Heat-treatment of Rod and Bar Stock ..... Feb. 186
Surface Finishes, The Comparoscope—An Optical Instrument for Evaluating.....Sept. 191
Surface Grinding Practice, Modern Flat. J. C. Arndt and W. S. Hallowell:
1 ..... May 168
2 ..... June 158
3 ..... July 169
Surface Smoothness Comparator, Comtor..Dec. 220
Surface Plate, DoAll ..... Apr. 220
Surplus Equipment, Preservation of.....Jan. 212-D
Surplus Equipment Should be Available to Educational Institutions at Reasonable Prices ..... Aug. 174
Surplus Machine Tools, How to Buy.....Apr. 170
Surplus Machine Tools, How to Deal with..Jan. 155
Surplus Machine Tools, Recommendations by Machine Tool Dealers on..... Jan. 161
Surplus Machine Tools to Work, Putting..Dec. 176
Surplus Machines, Change in Priorities for Purchasers of ..... July 200
Surplus Machines for Demonstration Rooms in Trade Schools ..... Jan. 179
Surplus Should be Placed on the Market Quickly, Government ..... Oct. 228
Sutton, C. M., Obituary of.....July 250
Swanson, G. S., Personal of.....Dec. 239
Sweeper, Magnetic Shop Floor ..... Nov. 178
Swing, R. J., Personal of.....May 240
Switches, Pressure-operated ..... Feb. 212
Swivelier Co.:
Grounded "Work-Lites" ..... Sept. 240
Swogger, Ross W., Personal of..... Jan. 212-B
Swope, Gerard, Personal of.....Mar. 240
Sykora, John C., Personal of.....Sept. 244
"Synkrete"—A Liquid Developed for Dust-proofing Concrete Floors.....Oct. 170
"Synox" Stainproof Finish ..... Feb. 194
Synthetic Material Superior to Natural Rubber ..... Nov. 175
Synthetic Oils Developed for Industrial Purposes ..... Feb. 183
Synthetic Rubber, see Rubber
Synthex Products Co.:
"Synkrete"—A Liquid Developed for Dust-proofing Concrete Floors ..... Oct. 170
System for Handling Single-point Tools at Watervliet Arsenal. Lieutenant Colonel E. G. Moffat ..... Mar. 161
Systems and Records Sometimes Outlive Their Usefulness ..... Mar. 174

T

Table Feed for Nichols Milling Machine, Power ..... Feb. 208
Tachometers, Scherr .....Dec. 213
Talon, Inc.:
Method of Checking Compound Angles..Dec. 182
Tank Manufacture, High-quality. William P. Hindman .....Jan. 135
Tanks, "Merry-Go-Round" Speeds Production of.....Sept. 210
Tanks, Self-propelled Turning Rolls Facilitate Automatic Welding of.....June 167
Tantalum Carbide, see also Tungsten Carbide
Tantung Thread Plug Gages.....Oct. 224
Tap-Cartridge, Inc.:
Tap-cartridges for Blind-hole Tapping....Oct. 220
Tap-conditioner, Improved .....Sept. 228
Tap Extractors, Walton Pipe.....May 198
Tap Grinder, Thin-body Chuck for Blake..Apr. 207
Tap-guiding Fixture, Dahlstrom.....June 204
Tap-holder, Barnaby "Jam-Proof".....Mar. 210
Taps and Cutting Hardened Steel, Disintegrators for Removing Broken.....Sept. 232
Taps, Disintegrator for Removing Broken..Apr. 236
Taps, "Electrolized" .....May 222
Taps Greatly Increase Crankshaft Threading Rate, Special .....July 226
Taps, Grinder for Sharpening Staybolt.....Dec. 210
Taper Inspection Plate, Ex-Cell-O.....July 206
Tapped in Eight Seconds, Threaded Spring Hangers.....Apr. 165
Tapping, and Spot-facing the Shank End of a Small Forging: Jig for Drilling.....Mar. 182
Tapping Attachments, Wahlstrom Automatic Drill Chucks and.....Feb. 210
Tapping, Boring, Drilling, and Milling Machine, Giddings & Lewis Multi-purpose.....Apr. 210
Tapping Fixture, Pond Automatically Controlled Turntable.....Aug. 205
Tapping Fixture, Viking Hand.....July 203
Tapping Head, Haskins Drill Press.....July 205
Tapping Head, Turret.....July 214
Tapping, "Hy-Mac" Special Machine for Drilling, Spot-facing, Counterboring, and.....July 204
Tapping Machine, Cleveland Horizontal Drilling and .....Jan. 198
Tapping Machine, Friction-drive.....Jan. 204-B
Tapping Machine, LeMaire Special Wheel-cylinder Drilling, Reaming, Boring, and ..... Mar. 204
Tapping Machines, Haskins.....Apr. 208
Tapping Motor Frames, Davis & Thompson Four-station Indexing Machine for Milling, Drilling, and .....Apr. 205
Tapping, Tap-cartridges for Blind-hole.....Oct. 220
Tapping Tool, "Grip-Slide" Threading and ..... June 220, July 224
Tatman, J. S., Personal of.....Apr. 244
Tavannes Single-spindle Automatic Screw Machines.....Apr. 220
Tawresey, Lieutenant-Colonel John S., Personal of.....Nov. 228
Tax Policy Encourages Buying Modern Equipment, British .....Feb. 188
Tax Policy that would Stimulate the Use of Better Equipment .....Jan. 182
Taxation, A Common-sense Theory of.....Dec. 164
Taylor, Earl A., Personal of.....Sept. 246
Taylor & Fenn Co.:
Variable-speed Drilling Machines.....Dec. 208
Taylor Machine Co.:
Utility Hoists .....July 208
Taylor, S. B., Personal of.....Sept. 246
"Teflon"—A Plastic with Unusual Resistance to Acids and High Temperatures.....Aug. 199
Telephone System Provides Service for Moving Vehicles, Mobile Radio .....Apr. 191
Temperature Resisting Alloys, High-.....Oct. 161
Templet Grinding Machine with Electronic Control, Sheffield.....Mar. 192
Tennessee Eastman Corporation:
Transparent Tenite Tubing Used for Containers for Drawings.....Sept. 164
Tensile-strength Testing Machine.....Dec. 206
Test of Neoprene, Results of Ten-year Aging ..... June 176
Test Table Used to Shake Out Faults of New Designs, Vibration .....Nov. 167
Tests on Single-point Cutting Tools Now Standardized, Life .....Aug. 175
Tester for Small Ferrous Metal Parts, Magnetic Hardness .....Feb. 198
Testers, General Electric Elongation.....June 208
Testing, Application of Cemented Carbides in Hardness .....Jan. 168
Testing by the Hypersonic Analyzer, Non-destructive Material .....Jan. 184
Testing Equipment, Plastics and Metal....Nov. 202
Testing Hammer for Portable Use, Hardnes ..... Sept. 188
Testing Machine, Brinell.....Feb. 208
Testing Machine for Sheet Materials, Bending and Torsion .....Sept. 216
Testing-machine Grip Designed to Hold Plastic Specimens .....Oct. 209
Testing Machine, Sheet-metal Ductility.....July 204
Testing Machine Simulates Actual Landing Conditions, Airplane Tire.....Mar. 173
Testing Machine, Tensile-strength.....Dec. 206
Testing Press, Beatty Hydraulic Tube-.....Apr. 236
Testing, see also Gaging, Inspecting
Testing Unit, Wilson Universal Hardness..July 220
Texas Co., The:
Hydraulic Oils for Industrial Equipment ..... Aug. 158
"Thalid X500" Thermosetting Resin Developed for Impression Molding.....Sept. 206
"Thalid X-100" Plastic Subetitute for Tung Oil in Sealing Magnesium Castings.....Nov. 174
Thermall High-frequency Heating Unit.....May 196
"Thermicast" for Producing Steel Castings ..... Jan. 191
"Thermonic" Induction Heating Coil for Localized Hardening.....Apr. 213
Thickness, Gage for Inspecting Bonds of Laminated Materials or Measuring Sheet ..... May 224
Tholl, J. F., Personal of.....Apr. 246
Thomas, Clinton G., Personal of.....July 245
Thomas Machine Mfg. Co.:
Edging Machine Designed to Prepare Plates for Automatic Welding.....Dec. 216
Inclinable Press .....Mar. 189
Thomas "Metal Master" for Welding and Similar Work .....Aug. 207
Thompson, F. Archer, Obituary of.....Sept. 252
Thompson Grinder Co.:
Crush Form Contour Grinding Machine ..... Sept. 226
"Truforming" Grinding Machine with Wheel-forming Crusher Rolls.....Apr. 203
Equipment for Steel Wool Manufacture..May 165
Thompson, Harold J., Personal of.....Dec. 239
Thompson, John, Personal of.....Dec. 246
Thoms, James E., Personal of.....Oct. 242
Thomson Electric Welder Co.:
Motor-driven Spot-welder.....Aug. 206
Thomson-Gibb Electric Welding Co.:
Model 6 Light-duty Seam-welder.....Sept. 220
Thomson Industries, Inc.:
Ball Bushing for Linear Motion.....July 209
Thor Pneumatic Impact Wrench.....June 226
Thread Cutting, Foulk Retract-A-Tool for..May 222
"Thread Faster" Attachment for Lathes, Lawrenz.....June 230
Thread Flat Rolling Dies, Jones & Lamson Automatic Self-opening Die-heads and Ground- .....June 208
Thread Gage, Bryant Portable.....Apr. 215
Thread Gage Sets, Reversible Plug and.....Apr. 232
Thread Gages, Reversible.....Nov. 220
Thread Grinding Machine, Landis Centerless ..... June 200
Thread-measuring Wires, Cemented-carbide Reversible-wire Plug Gages and.....Apr. 224
Thread-measuring Wires, Van Keuren Carboloy Plug Gages and.....Mar. 216
Thread-milling Machine, Cross Rotary.....June 204
Thread Milling Machine, Cross Special Boring, Facing, and.....Nov. 200
Thread Milling Machine, Plan-O-Mill.....Oct. 208
Thread Plug Gage, "Reverso".....May 220
Thread Plug Gages, Tantung.....Oct. 224
Thread Plug Gages, Tungsten-carbide.....Nov. 200
Thread Ring Gage, Woodworth Adjustable ..... Apr. 222
Thread Ring Gages, Extra Clearance Provided at the Roots of.....Jan. 192
Thread-rolling Machine, Reed.....June 204
Thread-rolling Process, Recent Applications of the .....Dec. 161
Thread Standards, Metric Screw.....Dec. 238
Threads by Single-wire Method, Gage for Checking Special Screw. Daniel E. McDonald ..... Oct. 190
Threads, Checking Pitch Diameters of Precidon Screw. Earle Buckingham.....Sept. 162

Threads, International Agreements Reached on Screw.....Jan. 154
Threading and Tapping Tool, "Grip-Slide" June 220, July 224
Threading Fuse Adapters on Landmaco Machine, Special Fixture for.....Oct. 212
Threading Hypoid Gears on Landmaco Machine. Special Chuck for .....Nov. 215
Threading Tools, Carboloy .....May 218
Threadmiller Corporation:
"Grip-Slide" Threading and Tapping Tool June 220
Threading and Tapping Tool — Correction July 224
Threadwell Tap & Die Co.:
High-speed Twist Drills .....May 212
Thrittmaster Products Division of Thomson Industries, Inc.:
"Ball Bushing" for Reciprocating Mechanisms Sept. 236
Timken-Detroit Axle Co.:
Aluminum Adopted for Truck Rear-Axle Housings.....Aug. 186
Timken Roller Bearing Co.:
Electronic Sound Gaging Device for Use by the Blind .....Sept. 189
Sound Gaging Device for Blind Inspectors July 174
Tin in Manufacturing, Substitutes for.....Apr. 193
Tippery, Frank C., Personal of.....Nov. 226
Tips to Shanks by Induction Heating, Brazing Tool. T. A. Vernor and E. F. Adams..Dec. 178
Tips to Tools, Induction Brazing of Carbide Apr. 177
Tire Testing Machine Simulates Actual Landing Condition, Airplane.....Mar. 173
Titan Tool Co.:
Two New Stud-driers.....Nov. 220
Tobias, Fred J., Personal of.....Mar. 235
Totte, Arthur R., Personal of.....Nov. 233
Tool Adjustment Block, Howard.....July 218
Tool Bit, "Shearcutter" .....June 224
Tool Bits, Copper "Cushioned" .....Dec. 200
Tool Engineers Have Greatly Speeded Up Reconversion.....May 180
Tool-grinding Fixture, Scherr All-purpose..May 216
Tool Grinding Machine, Cincinnati Monoset Cutter and.....May 194
Tool Grinding Machines, Grand Rapids Hydraulic-feed Universal and.....Nov. 204
Tool-holder, Bakewell Quick-clamping.....Dec. 230
Tool-holder, Kett Floating.....Dec. 222
Tool-holders, Cooper-Bessemer Turning and Cutting-off.....May 210
Tool Resists Severe Impact on Maintenance Job, Carbide .....June 181
Tool-room Precision on a Mass Production Basis. Charles O. Herb.....Oct. 139
Tool Shanks, Fixture for Milling.....Mar. 181
Tool Shanks Increase Production, Multiple Milling of. Earl Weaver.....June 183
Tools and Adapter for Small-lot Runs, Form Feb. 218
Tools at Watervliet Arsenal, System for Handling Single-point. Lieutenant-Colonel E. G. Moffat.....Mar. 161
Tools During Shipment and Storage, Protecting Cutting.....Aug. 171
Tools, Equipment Designed to Facilitate the Use of Diamond. Dr. G. Schlesinger and Dr. D. F. Galloway.....June 179
Tools for Use in Bending Machines. E. J. DeWitt and Harry S. Nachman.....May 188
Tools, Kennametal "Clamped-On-Tip".....Aug. 222
Tools Now Standardized, Life Tests on Single-point Cutting.....Aug. 175
Tools to Eliminate Chatter, Grinding Lathe. C. W. Christiansen.....May 174
Tools, Universal Rake-angle Checker for Form-relieved .....Feb. 200
"Toolmaker Microscope," Gaertner.....Aug. 206
Tooth Wear and Failure, Gear .....Apr. 166
Topflight Tool Co.:
Sheet-metal Dimpling Tool and Yoke..Mar. 199
Torch Cutting Operation, Eliminating Distortion in .....Aug. 185
Torrance Brass Foundry:
Centrifugally Cast Aluminum-bronze Bushing Stock .....Aug. 200
Torrence, George P., Personal of Apr. 251, July 238
Torrington Co.:
A Manual on Needle Bearings .....Oct. 165
Torsion Testing Machine for Sheet Materials, Bending and .....Sept. 216
Towne, R. Louis, Personal of .....Jan. 212
Tracer, Profilometer .....Dec. 224
Trade Can be Stifled by Unwise Policies, Our Foreign .....June 163
Trade, see also Export. Market, Foreign. Industry
Training Course on Electrical Instruments, Westinghouse .....Aug. 172
Training Draftsmen at the Glenn Martin Plant July 173
Training Program, Ford Dealers Offer Veterans an "Earn while You Learn".....Feb. 248
Training, see also Apprentices, Education, School, Vocation
Training Supervisors in Human Relations..June 173
Transformer that Weighs Only One-third Ounce .....Apr. 191
Transmission, Salsbury Automatic .....July 220
Trbojevich, Nikola, Personal of .....Dec. 246
Trecker, Joseph L.:
Increased Production the Solution to Economic Problems .....July 178
Tri-Bit Boring-bars .....Nov. 216
Tripler Machine Tool Co.:
Lidkoning Centerless Grinding Machine Feb. 203
"Tri-San"—A New Material for Industrial Hygiene Uses .....Sept. 207
Troxide Solutions for Bright Dipping.....Mar. 184
Troy, W. C.:
Utilizing Residual Forming Stresses in Flat Steel Springs .....June 152
"Truarc" Retaining Rings, Waldes .....Oct. 222
Truck and Sump Cleaner, Honan-Crane Oil-transfer .....Feb. 216
Truck Maintenance, Safe Loading Chart Improves .....June 168
"Truforming" Grinding Machine with Wheel-forming Crusher Rolls .....Apr. 203
Trundle Engineering Co.:
Government Surplus Should be Placed on the Market Quickly .....Oct. 228
Truscon Laboratories, Inc.:
Chlorinated Rubber Base Paint is Again Available .....Mar. 185
Tryon, H. K., Personal of.....Aug. 242
T-slots with Carbide-tipped Cutters, Milling Jan. 187
Tube-testing Press, Beatty Hydraulic.....Apr. 236
Tube, Troubles in Steam Turbines or Other Rotating Equipment Detected by Resonance Aug. 171
Tubes, Die for Punching Holes in Short....Jan. 188
Tubes with Carbide Lathe-center Tip, Flaring Jan. 150
Tubing Data Chart, Stainless-steel.....Apr. 199
Tubing for Low-temperature Applications, Nickel-steel .....Jan. 191
Tubing Has Improved Flexibilty, Heat-resisting Plastic .....Mar. 185
Tubing Pressure Chart .....Sept. 185
Tufts, Major Carl R., Personal of .....July 240
Tumbling, Norton Alundum Abrasives for Wet Feb. 205
Tungsten Carbide Tool Co.:
Carbide-tipped Core-drills .....Oct. 209
"Vibra-Cushioned" Carbide Cutters for Face-Milling Steels .....Apr. 225
Turbines or Other Rotating Equipment Detected by Resonance Tube, Troubles in Steam .....Aug. 171
Turbines to Furnish Power for Airplanes, Gas Mar. 173
Turbojector Molding Machine, H-P-M.....May 195
Turco Products, Inc.:
Lubricant Developed for High-speed Chain Conveyors .....Jan. 190
Portable Steam Cleaning Unit.....June 177
Turnbull, W. D., Personal of.....Sept. 250
Turner Brothers, Inc.:
Keyless Drill Chuck .....Nov. 222
Turning and Boring a Ring-shaped Part, Special Fixture for.....Nov. 169
Turning and Cutting-off Tool-holders, Cooper-Bessemer .....May 210
Turning, Lathe Set-up for Spherical.....July 195
Turntable Tapping Fixture, Pond Automatically Controlled .....Aug. 205
Turret for Axelson Lathe, Ram Type.....June 216
Turret Lathe with Pendant Control, Bullard "Cut Master" Vertical .....Mar. 202
Turret Mill Equipped for Special Boring Operation, Vertical .....Apr. 222
Turret, Weaver Multiple-spindle .....Aug. 210
Turret with Double Drive, Enco Lathe....Mar. 194
Tweezer-Weld Corporation:
Besco Tweezer Spot-welding Machine....Mar. 204
Twist Drill, see Drill
Tyler, Jerry, Obituary of .....July 250
Tyler, Robert L., Personal of.....Aug. 238

U

U.D.A. Co.:
Portable Positioner for Supporting Vise..Jan. 196
Uecker, William C., Personal of.....Dec. 248
"Ultra-Speed" Welder Control Unit.....Mar. 197
"Umbrella Plug" for Covering Heads of Hollow Cherry Rivets.....Feb. 226
"Unbrako" Key Kit with Nine Screwdriver Bits Sept. 230
Underwood, James M., Personal of.....July 246
Underwood, M. R., Personal of.....Mar. 230
"Unichrome Dip"—A Corrosion Protection for Cadmium and Zinc.....Jan. 190
"Uni-Matic" Turning Machine.....Mar. 187
Union Carbide and Carbon Research Laboratories, Inc.:
Secret Wartime High-temperature Alloys Now Available for Peacetime Use.....July 183
Union-Management Cooperation, A Step toward Real .....Aug. 188
Union Rules Reduce Employment, Restrictive Mar. 166
Uni-Point Radial Saw, Monarch.....Apr. 216
"Uniseal" Thread and Gasket Sealing Compound .....Mar. 185
"Unitable" Sectionalized Assembly or Production Line.....May 167
United Chromium, Inc.:
Corrosion Protection for Cadminum and Zinc with One Dip.....Jan. 190
United States Rubber Co.:
New Plastic Resins Provide High-strength Materials.....Sept. 207
Heat-resistant Synthetic Rubber for Forming Magnesium.....Jan. 181
Multi-Flex Ducts for Air, Gases, and Powdered Material .....May 172
U. S. Tool & Mfg. Co.:
Radius and Tangent Dresser for Grinding Wheels .....Sept. 232
United Transformer Corporation:
A Transformer that Weighs Only One-third Ounce .....Apr. 191
"Unitite, Jr.," Packless Valve .....Apr. 222
Universal Boring Machine Co.:
Horizontal Boring Machine.....Oct. 206
Milling, Drilling, and Boring Machines..Jan. 199
Universal Drafting Machine Co.:
"Boardmaster" Drafting Machine.....Aug. 203
Universal Engineering Co.:
Turret Tapping Head .....July 214
Universal Joints, "White Line" Precision-made May 222
University Machine Co.:
Pocket-size Set of Surface Finish Standards Dec. 218
Unsatisfactory Equipment, Buyer's Right to Return. Leo T. Parker.....Oct. 194
Utz, Ernst J., Personal of.....Sept. 242

V

Vacu-Blast Co.:
Portable Blast Cleaning Equipment.....July 206
Vacuum-grip Speed Lathe, Crozier.....July 218
Vail, L. E., Personal of.....July 246
Val air Corporation:
Control Valves .....Aug. 220
Valve, Flex-Tube Non-metallic Three-way..July 209
Valve, Four-way Air Control.....July 220
Valve Functioning, Intermittent Motion for Changing Timing Interval for Air-.....May 182
Valve, Gerotor Floating Piston Type Hydraulic Feb. 224
Valve, Handle-grip Air Control.....Mar. 220
Valve, "Modernair" Pneumatic Three-way Pilot Feb. 218
Valve Rocker Arms, Surface Broaching Simplifies Machining of. Harry H. Gotberg Sept. 176
Valve, Ross Solenoid-controlled Air.....July 218
Valve Seats Substituted for Those of Metal, Nylon .....Mar. 185
Valves for Post-war Engines, Eatonite Makes Possible Better .....Sept. 206
Valves, Hanna Air and Hydraulic Control..Apr. 222
Valves, Hydro-Aire Multi-way Selector.....Aug. 210
Valves, Machining Stainless-steel. A. P. Nelson July 148
Valves, Mead Combination Three- or Four-way Air .....Feb. 222
Valves, Val-air Control .....Aug. 220
Van der Pyl, Edward, Personal of.....Sept. 242
Van Diver, Vernon H., Personal of.....Aug. 238
Van Dorn Iron Works Co.:
Plastics Injection Press.....June 224
Vangtronic Corporation:
Bench Type Spot-welder.....July 209
Van Gundy, J. C.:
Hydraulic Oils for Industrial Equipment Aug. 158
Van Hala, H. A., Personal of.....May 234
Van Keuren Co.:
Carboloy Plug Gages and Thread Measuring Wires .....Mar. 216
Carboloy Gear-measuring Wires .....June 226
Van Norman, Charles E., Obituary of.....Apr. 254
Van Norman Co.:
No. 2 Horizontal Milling Machine.....Nov. 198
No. 3 Horizontal Milling Machine.....Dec. 204
Horizontal Milling Machine for Medium and Small Size Work .....Jan. 200
Van Poppelen, F. J., Personal of.....Sept. 249
Variable-speed, see Speed
Varnish for Impregnating Electrical Equipment, Silicone .....Jan. 190
Veale, George W., Personal of.....Mar. 236
Vectolite Permanent-magnet Material .....July 236
Vega Die Steel that Hardens in Heavy Sections Apr. 200
Vernor, T. A.:
Brazing Tool Tips to Shanks by Induction Heating .....Dec. 178
Veterans an "Earn while You Learn" Training Program, Ford Dealers Offer.....Feb. 248
Veterans, Clearing up a Misconception in the Employment of Discharged. C. Charles Burlingame .....Nov. 163
Veterans, Re-employment of.....Nov. 159
Veterans' Refresher Courses .....Oct. 172
Veterans, Successful Employment of Blind Aug. 156
"Vibra-Cushioned" Carbide Cutters for Face-milling Steels.....Apr. 225
"Vibrashock" Mounting for Delicate Equipment .....Feb. 224
Vibration and Simplify Leveling of Machinery. Vibro-Levelers Reduce .....Dec. 187
Vibration in a Lathe by Relocating Motor and Countershaft, Reducing. William Henry Morrison.....Sept. 194
Vibration Test Table Used to Shake Out Faults of New Designs.....Nov. 167
Vibro-Levelers Reduce Vibration and Simplify Leveling of Machinery .....Dec. 187
"Vibron" Plastic Resins Provide High-strength Materials.....Sept. 207
Viculoy Copper Alloy Provides Unusual Strength and Hardness.....Apr. 201
Viking Tool & Machine Corporation:
Hand Tapping Fixture.....July 203
Vinylite Plastics — New Applications of a Product of the Bakelite Corporation.....Dec. 185
Vise, Heinrich "Grip-Master" .....Jan. 209-A
Vise "Milpal" Machine .....May 210
Vise, Parallel-angle Magnetic .....Dec. 230
Vise, Portable Positioner for Supporting....Jan. 196
Vision Checking Employes' .....Apr. 199
Vision, Course in Industrial.....Oct. 183
Visual Education by Means of Drawings, Exploded Views, and Transvision.....Mar. 180
Visual Production Planning, Inc.:
Machine Tool Scale Models for Plant Layouts.....Aug. 175
Vocation, see also Apprentices, School, Training, Education

W

Wacker, E. D., Personal of.....Oct. 238
Wage Plans, Incentive.....Sept. 204
Wages and Less Efficiency is a Dangerous Combination, Higher .....Apr. 194
Wages, Better Manufacturing Methods Must be Devised to Compensate for Higher.....June 197
Wages in the Face of Reduced Production, Effect of Increasing.....Nov. 155
Wages Mean Higher Prices, No One Benefits; When Higher.....Feb. 188
Wagner Electric Corporation:
Hydraulic Brake Control Unit for Crane Bridges .....Dec. 218
Wagner, J. A., Personal of.....May 239
Wagner, Jr., C. H., Personal of.....Feb. 240
Wahlstrom Tool Division of American Machine & Foundry Co.:
Automatic Drill Chucks and Tapping Attachments.....Feb. 210
Waindle, Roger F., Personal of.....Feb. 234
Waldes Kohinoor, Inc.:
"Truarc" Retaining Rings .....Oct. 222
Wales-Strippitt Corporation:
Hole-punching Units .....Feb 226
Walker Co., H. V.:
"Porciflex" Fast Drying Enamel Developed to Speed Production .....Mar. 185
Wallace, Jr., Lieutenant Leland.....Apr. 244
Wallace Supplies Mfg. Co.:
Cold-bending of Pipe and Metal Shapes..Apr. 141
Tools for Use in Bending Machines.....May 188
The Hydraulic Circuit in Bending Machines June 149
Designing Work for Bending.....July 154
Wallen Mfg. Co., G. J.:
Samson Grinding-wheel Dresser.....May 212
Walling, Frank E., Personal of.....Nov. 233
Walsh Press & Die Co.:
New Line of Punch Presses.....Nov. 210
Walsh, R. E., Personal of.....Nov. 224
Walton Co.:
Pipe Tap Extractors.....May 198
Walworth, W. M., Personal of.....Feb. 238
Warco All-steel Welded Presses.....May 200
Warmee, Lieutenant-Commander Paul R., Personal of .....Dec. 242
Warner & Swasey Co.:
Standardization of Electrical Equipment for Machine Tools .....Jan. 176
Five-spindle Automatics.....Jan. 193

Road Machinery Added to Company's Line ..... Mar. 238
Warren City Mfg. Co.:
Warrco All-steel Welded Presses ..... May 200
Warzeski, Frank S., Obituary of ..... Feb. 245
Washer Cutter, Wyco Heavy-duty Hole and ..... July 222
Washing and Rinsing Unit, Optimus ..... Sept. 234
Washing Machine for Small Parts, Optimus ..... Nov. 202
Washing Machine, Portable Industrial ..... Oct. 226
Water (Under-) Oxygen Cutting Equipment ..... Oct. 228
Water Welding Photographed for the First Time, Under- ..... Oct. 148
Watervliet Arsenal:
System for Handling Single-point Tools .. Mar. 161
Watkins, Stanley P., Personal of ..... Oct. 234
Watson, E. A., Personal of ..... May 239
Watson-Stillman Co.:
General-purpose and Heavy Forming Presses ..... Aug. 214
Watt, R. Nevin, Personal of ..... Aug. 247
Waverly Petroleum Products Co.:
Non-hazardous Solutions Developed for Bright Dipping ..... Mar. 184
Ways, Carbide Used for Tool Grinder ..... Dec. 160
Ways for Machine Tables, Gray Non-metallic ..... May 208
Wear and Failure, Gear Tooth ..... Apr. 166
Weaver Aircraft Corporation:
Multiple-spindle Turret and Variable-speed Unit for Drill Presses ..... Aug. 210
Weaver, Earl:
Multiple Milling of Tool Shanks Increases Production ..... June 183
Weaver, William J., Personal of ..... Mar. 235
Webb Corporation:
Initial Pinch Type Bending Roll ..... Nov. 220
Webber, Charles, Personal of ..... May 232
Weber, H. F. R., Personal of ..... Sept. 242
Webster, R. A.:
Hardness Gages ..... Aug. 216
Weddell Tools, Inc.:
Tri-Bit Boring-bars ..... Nov. 216
Weingartner, J. W., Personal of ..... Aug. 247
Weiss, Edwin:
Metal Spinning by Modern Methods ..... Nov. 141
The Technique of Metal Spinning ..... May 159
Welded Machinery Parts, What the Designer Should Know About. George L. Snyder:
1 ..... Jan. 157
2 ..... Feb. 167
Welded Tanks, Manufacture of High-quality All-. William P. Hindman ..... Jan. 135
Welder a Precise Production Tool, Electronic Control Makes Bench. L. J. Gottschalk, Jr. ..... Sept. 168
Welder Control Unit, "Ultra-Speed" ..... Mar. 197
Welder, Davis & Murphy Spot- ..... Mar. 207
Welder, Foot-operated Spot- ..... Nov. 206
Welder, Lincoln "Fleet Arc Jr." ..... Dec. 208
Welder, Lincoln Portable ..... Mar. 207
Welder, "Lincolnweld" Process ..... Apr. 220
Welder, Portable Arc- ..... Apr. 230
Welder Sub-assemblies, Induction Heater Made from Standard Resistance ..... Feb. 156
Welder, Thomson Motor-driven Spot- ..... Aug. 206
Welder, Thomson Light-duty Seam- ..... Sept. 220
Welder, Vangtronic Bench ..... July 209
Welder with Diesel Engine Drive, Lincoln .. Feb. 201
Welders, Berkeley Seam- ..... Jan. 209-A
Welders, Sciaky Overhead Spot- ..... Dec. 218
Weldex, Inc.:
Improved Precision Spot-welding Machine ..... May 206
Welding — A New Motion Picture, This is Resistance ..... June 182
Welding Aluminum, Improved Flux for Gas- ..... Jan. 191
Welding and Similar Work, Thomas "Metal Master" for ..... Aug. 207
Welding, Automatic Positioning Control Speeds ..... Nov. 176
Welding Award, Undergraduate ..... Feb. 248
Welding Compound, General Electric Arc- ..... Jan. 208-B
Welding Electrode, Rod, see Electrode, Rod
Welding, Gear Production Problems Solved by Automatic. R. P. Sharer ..... Nov. 153
Welding Machine, Besco Tweezer Spot- ..... Mar. 204
Welding Machine, Weldex Spot- ..... May 206
Welding of Alloy Steels, Arc ..... Aug. 173
Welding of Tanks, Self-propelled Turning Rolls Facilitate Automatic ..... June 166
Welding Photographed for the First Time, Under-water ..... Oct. 148
Welding, Prizes for Papers on Resistance .. Feb. 246
Welding Process Eliminates Residual Stresses, New Electric ..... Dec. 190
Welding Process Increases Production Three-fold, Automatic ..... Feb. 184
Welding, Steam Platens Produced by ..... Sept. 178
Welding, Thomas Edging Machine Designed to Prepare Plates for Automatic ..... Dec. 216
Welding with Storage-battery Power, Resistance ..... Aug. 167
Weld-spatter-resistant Compounds ..... Jan. 204-B
Welker, E. H., Personal of ..... Apr. 251
Wellman Engineering Co.:
Stack-cutting Provides Fabricating Short-cuts ..... Nov. 160
Wendt-Sonis Co.:
Diamond "R" Files and Hones ..... Feb. 224
Milling Cutter with Interchangeable Carbide Blades ..... Aug. 224
Wenning, Owen H., Personal of ..... June 240
Westbrook, Francis A.:
Working Conditions in a Machine Shop Improved by Sound-conditioning ..... June 188
Western Electric Co.:
Mobile Radio Telephone System Provides Service for Moving Vehicles ..... Apr. 191
Westinghouse Electric Corporation:
Electronic Control Makes Bench Welder a Precise Production Tool ..... Sept. 168
Looking Along Assembly Aisles through a Huge Generator Frame ..... Sept. 189
Three-dimensional Plant Lay-outs ..... Sept. 194
Plastic "Glass" Panels for Control Boards ..... Oct. 232
Precipitron Electrostatic Air Cleaner Provides Dust-free Atmosphere in Laboratory ..... Oct. 245
Improved Methods for Lapping Radius-formed Pivot Bearings ..... Nov. 169
Brazing Tool Tips to Shanks for Induction Heating ..... Dec. 178
Improved Grease for Ball and Roller Bearing Motors ..... Dec. 196
New High-frequency Laboratory in Los Angeles ..... Dec. 238
The Microbalancer—A Supersensitive Balancing Machine ..... Jan. 181
Single-pole Magnetic Contactor ..... Jan. 208-B
Direct-current Motor with Wide Speed Variation ..... Jan. 210
Bright-hardening of Tools and Machine Parts in Controlled Atmospheres ..... Feb. 158
New Process for Producing Molybdenum Developed ..... Feb. 195
Portable Brazing Equipment ..... Feb. 205
Gas Turbines to Furnish Power for Airplanes ..... Mar. 173
Furnace Equipment for Bright-hardening ..... Mar. 178
Electric Starter Developed for Aviation Gas Turbines ..... Apr. 191
One-hundreth Anniversary of the Birth of George Westinghouse ..... Apr. 193
Tenth Annual Machine Tool Electrification Forum ..... May 179
Utilizing Residual Forming Stresses in Flat Steel Springs ..... June 152
Present-day Motor Drives and Other Electrical Equipment for Machine Tools .. June 164
Safe Loading Chart Improves Truck Maintenance ..... June 168
Multiple Milling of Tool Shanks Increases Production ..... June 183
Future Requirements for Machine Tools ..... June 187
Standard Grays for Engineering Equipment ..... June 192
Electric Motors of Light Weight per Horsepower ..... June 194
Productive Power Exhibit ..... July 182
George Westinghouse Scholarships Awarded ..... July 191
Portable Brazers ..... July 216
Self-contained "Package" Power Plants .. July 224
Fixture with Two Carbon Electrodes Facilitates Soldering of Small Parts ..... July 227
Troubles in Steam Turbines or Other Rotating Equipment Detected by Resonance Tube ..... Aug. 171
Training Course on Electrical Instruments ..... Aug. 172
New Method of Preparing Bearing Shells for Babbitting ..... Aug. 226
Wetzler, Justin J., Personal of ..... Aug. 236
Wheel-cylinder Drilling, Reaming, Boring, and Tapping Machine, LeMaire Special ..... Mar. 204
Wheel, Diamond Cup-shaped Honing ..... Jan. 208
Wheel Dresser and Lathe Angle-plate, Grinding ..... Nov. 212
Wheel Dresser, Samson Grinding ..... May 212
Wheel Drying Rooms, Humidity a Cause of Trouble in Abrasive ..... Oct. 167
Wheel Utility Set, Bay State Abrasive .... Sept. 224
Wheels and Stones, Bay State Diamond Abrasive ..... Jan. 209-C
Wheels, Bayflex Abrasive Cut-off ..... Feb. 222
Wheels, BuXite Grinding ..... Sept. 218
Wheels, Diamond Dressing Device for Multi-Ribbed Thread Grinding ..... Oct. 220
Wheels, J & S Radius- and Angle-dresser for Grinding ..... Nov. 222
Wheels, New Applications of Crush-dressing of Grinding. Carl Linxweiler ..... Jan. 143
Wheels, Proposed Revision of Simplified Practice for Grinding ..... Aug. 185
Wheels, Radius and Tangent Dresser for Grinding ..... Sept. 232
Wheels, Using Diamonds for the Crush-forming of Grinding. Harry L. Strauss, Jr. ..... Jan. 179
Wheels, Zagar Angle-dresser for Grinding .. Sept. 238
Wheeler, Wilmot F., Personal of ..... Apr. 246
Wheelock, Lovejoy & Co.:
One Hundredth Anniversary Celebrated .. June 189
White, Jr., W. R., Personal of ..... Mar. 228
"White Line" Precision-made Universal Joints ..... May 222
White, W. D.:
Milling Fixture for Airplane Parts ..... Nov. 180
Whiting, Edward M., Personal of ..... Dec. 239
Whitmore, Harley W., Personal of ..... Oct. 236
Whitney, Harry L., Personal of ..... Dec. 242
Wick, Charles H.:
Friction Band-sawing of Hard Materials ..... June 169
Wickes Brothers:
Automatic Crankshaft Turning Lathe .... Mar. 196
Automatic Multiple Crankpin Turning Lathe ..... June 213
Wickman Corporation:
Bench Grinding and Lapping Machine .. Aug. 211
Wilcox, Earle D.:
Magnetic Inspection in Modern Industry ..... Sept. 179
Wilcox-Rich Division of Eaton Mfg. Co.:
Eatonite Makes Possible Better Valves for Post-war Engines ..... Sept. 206
Chemical Treatment of Highly Finished Metal Surfaces ..... July 166
Wilder, Howard H., Personal of ..... Apr. 251
Wiley, Lieutenant-Colonel C. F., Personal of ..... Nov. 230
Willey's Carbide Tool Co.:
Induction Brazing of Carbide Tips to Tools ..... Apr. 177
Carbide-tool Grinding Machine ..... May 208
Williams, Clarence Leslie, Personal of ..... Oct. 238
Williams, Donald, Personal of ..... Oct. 236
Wilson, E. C., Personal of ..... June 247
Wilson, Forrest G., Personal of ..... Jan. 211-C
Wilson, James S., Personal of ..... Sept. 244
Wilson, Jr., Harry, Personal of ..... May 240
Wilson, Jr., R. M., Personal of ..... June 242
Wilson, S. R.:
Light-weight Blanking and Forming Press ..... Aug. 207
Wilson Mechanical Instrument Co., Inc.:
Universal Hardness Testing Unit ..... July 220
Winding Reel, Heavy-duty Constant-speed, Constant-tension ..... Oct. 218
Windows, Plastic Glazings Tested for Automobile ..... Apr. 201
Winne, Harry A., Personal of ..... Oct. 238
Winkler, James V., Personal of ..... Oct. 234
Winters, Paul H., Personal of ..... Aug. 240
Wire, General Electric Elongation Testers for Copper ..... June 208
Wire, High-strength ..... June 197
Wire Method, Checking Pitch Diameters of Precision Screw Threads by the. Earle Buckingham ..... Sept. 162
Wire Method, Gage for Checking Special Screw Threads by Single-. Daniel E. McDonald ..... Oct. 190
Wire-rope Manufacture, Electronic Equipment Facilitates. P. Somerville, L. R. Hunt, and J. D. Campbell ..... Jan. 171
Wires, Cemented-carbide Reversible-wire Plug Gages and Thread-measuring ..... Apr. 224
Wires, Van Keuren Carboloy Gear-measuring ..... June 226
Wires, Van Keuren Carboloy Plug Gages and Thread-measuring ..... Mar. 216
Wood, Cal R., Personal of ..... Feb. 240
Woodward, Foster R., Personal of ..... Sept. 242
Woodworth Co., N. A.:
Air-operated Diaphragm Chucks ..... Dec. 226
"Cone-Lok" Unit and Fixture Clamp .... Feb. 216
Adjustable Thread Ring Gage ..... Arr. 222
"Miniature Cone-Lok" Jigs ..... May 216
Wool Manufacture, Equipment for Steel .... May 165
Woolson, William D., Obituary of ..... Jan. 212-D
Workers will Pay Large Part of Increased Automobile Shop Wages, Industrial ..... May 240
"Work-Lites," Swivelier Grounded ..... Sept. 240
Workman, Joseph E., Personal of ..... Aug. 242
Worthington Pump & Machinery Corporation:
Variable-stroke Pump ..... May 201
Wrench, Thor Pneumatic Impact ..... June 226
Wright, Alexander M., Personal of ..... Oct. 238
Wright, C. O., Personal of ..... Feb. 234
Wright, F. A., Personal of ..... Sept. 250
Wright, James A., Personal of ..... June 240
Wyble Engineering Co.:
Universal Hydraulic Presses ..... July 207
Wyco Heavy-duty Hole and Washer Cutter ..... July 222
Wyco Hy-Speed Saw ..... Apr. 224
Wyman-Gordon Co.:
The Forging of Magnesium ..... June 141
Wyzenbeek & Staff, Inc.:
Wyco Hy-Speed Saw ..... Apr. 224
Wyco Heavy-duty Hole and Washer Cutter ..... July 222

X

X-ray Photometer Records Presence of Chemical Elements In Materials ..... Aug. 187
X-ray Pictures Through Fifteeen Inches of Steel, Betatron Makes ..... Jan. 180
X-rays, Safety Code for Industrial Use of .. July 187

Y

Yale & Towne Mfg. Co.:
Carboloy Pins Reduce Maintenance of Knurling Tools ..... May 167
Yankee Precision Products Co.:
Precision Electric Surface Gage ..... Jan. 201
Lightronic Gage-head ..... July 207
Yeoman, I. F.:
Broaching Holes through Boring-bars and Tool-holders ..... Feb. 191
Yerger, C. W., Personal of ..... Oct. 238
York, A. G., Personal of ..... Apr. 246
Young Arbor Co.:
Expanding Mandrel ..... Feb. 222
Young, Raymond W., Personal of ..... Nov. 228
Youngman, Fred T. H., Personal of ..... Feb. 240

Z

Zagar Tool, Inc.:
Angle-dresser for Grinding Wheels ..... Sept. 238
Collet for Indexing Table Type Machine Tools ..... Oct. 212
Improved Horizontal Broaching Machine ..... Nov. 216
Broaches for Vertical and Horizontal Machines ..... Nov. 220
Cam Grinding on a Cylindrical Grinder .. Feb. 180
Gearless Drill Heads ..... May 210
Zapp, A. R., Personal of ..... Jan. 212-B
Zeller, Robert M., Personal of ..... Feb. 240
"Zephyr 16" High-speed Metal Saw ..... May 199
Zinc Die-castings for Bomb Nose Pistols .... Oct. 193
Zinc with One Dip, Corrosion Protection for Cadmium and ..... Jan. 190
"Zipper-Et" Portable Arc-welder ..... Apr. 230
Zurn Mfg. Co., J. A.:
Lucite Transparent Casing for Duplex Pipeline Strainer ..... Aug. 199